ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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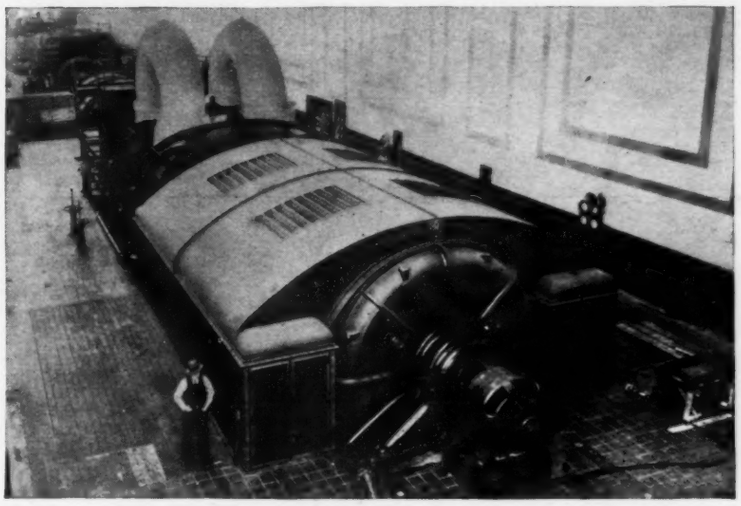

160,000-kw. unit, East River station, New York Edison Co.

NOVEMBER 15, 1930

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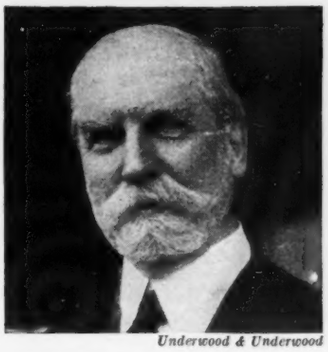
ELECTRICAL WORLD

for the Week Ending

November 15, 1930



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CHARLES EVANS HUGHES,
Chief Justice
United States Supreme Court.

Utility stocks lowest in three years

Hoover Dam construction to be pushed

Public service is a public trust, says Roosevelt

—**Stock market hits new lows.** Alternate slumps and rallies follow election day. Selected utility group averages reach lowest since 1927. Price earnings ratios touch 19 against 1929 high of 35—*p. 927*

—**320 kw. for football lighting** at Detroit. Six 100-ft. towers support groups of high-wattage lamps. Previous difficulties appear to have been overcome in this $25,000 sports lighting job—*p. 920.*

—**Election Day telltales point** to further baiting of utilities in political arena. Advocates of public ownership and federal regulation heartened by election results in many states—*p. 892.*

—**Service and meter costs cut** by practices beyond the code as at present drawn. Perhaps a revision is badly needed; perhaps distribution costs will be cut appreciably at this point—*p. 918.*

—**Ford has adopted electric heat** on production-line basis to maintain high-quality forgings in strictly uniform ouptut. Use of rod-resistor furnaces has minimized maintenance work—*p. 902.*

—**Power consumed in industry** shows further recession of approximately 8 per cent from September level. Almost all industry groups show declines—*p. 929.*

—**Faults to ground are reduced** by Petersen arcing-ground suppressor. German performance data prove ground protection feasible at lower cost, less complexity and with few interruptions—*p. 908.*

—**Circuit-breaker performance** is affected by the power factor of the short-circuit current and the "circuit speed" as it influences rate of rise of voltage after zero current, extensive tests show—*p. 913.*

NEWS OF THE WEEK

Clark Compares Independent and "Chain" Electrical Wholesalers

FOUR HUNDRED electrical wholesalers gathered this week at the William Penn Hotel in Pittsburgh for the annual fall meeting of the National Electrical Wholesalers' Association. It was a working program with an unusually large number of committees in action and a long schedule of conferences between different manufacturers and their distributors. Committee meetings began on Monday, general sessions on Wednesday, continuing through Friday.

B. W. Clark of the Westinghouse Electric Supply Company, speaking as chairman of the executive committee of the association, compared the situation of the national "chain jobber" and the independent. "I have encountered a feeling," he said, "that the national wholesaler has a different set of conditions—a method of operating which differentiates him from the independent. This presupposes bulk buying, direction of every move from a headquarters office, dehumanizing of the business. Let me say that when the local division manager of a national wholesaler loses control of the main functions of his business, when he becomes a high-class salaried clerk, his institution will suffer and the dominance of the independent jobbing house will be assured. Our business is localized and intimate. Therein lies its greatest strength. True, the national wholesaler has the means through comparative statements to size up the efficiency of any division, to provide continuity in management, to standardize writing methods. But independent wholesalers can have such information on operating costs and methods as they desire. They have a wide choice of lines, and the manufacturers of these lines must have representation. The nature of our industry is such that few manufacturers could successfully undertake their own distributing. The national companies are as keenly interested in the success of the individual wholesalers as they are themselves."

The program embraced addresses on the expanding market for electric ventilation by P. D. Briggs of the National Association of Fan Manufacturers and on the relations of the purchasing agent and the wholesaler by G. A. Renard of the National Association of Purchasing Agents. The wholesalers' medal and purse of the James H. McGraw award was presented to George E. Cullinan, former chairman of the executive committee of the association (see page 930). Mr. Cullinan also received an engrossed resolution of appreciation.

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Election Aftermath at the National Capital

POLITICAL CROSS-CURRENTS at Washington, as affected by the elections, present some aspects of especial interest to the electric utilities.

Democratic gains in the Senate and House of Representatives will bring to the capital more legislators who are likely to oppose encroachment on the rights of the state. Some think this will mean additional support for the principle involved in the Attorney-General's decision in the New River case, which would leave to the states the conditions under which water power may be developed on non-navigable streams. Others expect that the strengthened ranks of those who are anxious to see all large public utilities brought under federal regulation will be able to dominate the situation.

In any short session of Congress legislation other than appropriation bills has small chance of enactment. This chance will be less than usual at the forthcoming short session owing to

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"ELECTRIC EYE" SCANS FIRE, PUTS IT OUT

—P. & A. Photos.

The hood exhibited above by L. W. Chubb, Westinghouse research engineer, incloses an "electric eye" which sweeps back and forth downward across the screen. When it discovers a blaze it stops and releases a stream of extinguishing fluid, then resumes its quest.

the desire of groups in each party to force an extra session which would give the newly elected Congress an opportunity to begin to function immediately after the session of the existing Congress which begins in December and terminates automatically on March 4. Senator McNary of Oregon, however, who is the assistant Republican leader in the Upper House, has announced that he intends to bring up the Norris bill on Muscle Shoals.

"As chairman of the conference committee," he says, "I shall call up the conference report immediately upon the convening of Congress to determine whether the measure sponsored by Senator Norris for government operation or the Reece bill to lease this project to private individuals shall prevail. As far as I can observe, I believe that the majority of the Senate is disposed to experiment in government operation of this great development."

Senator Fess, chairman of the Republican National Committee, said he favored private operation, but would support government operation rather than see the power go to waste. He agreed that the election "showed that the major parties will be forced to take a definite stand on the subject."

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POLYCHROMATIC FLOODLIGHTING IN ILLINOIS

Decatur, Ill., is the scene of the first application of the General Electric Company's new thyratron-tube-controlled polychromatic floodlighting system. Rising many stories as a brilliant white tower, with the walls above bathed with ever-changing color effects, the administration building of the A. E. Staley Company, at the edge of the city, is seen for miles in every direction. Two hundred projectors are used.

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Insulation Theorists Exchange Research Data

CONTEST FOR THE HONOR of accounting for dielectric behavior continues unabated. The proponents of the three largely held and largely incompatible theories—dipolar molecules, anomalous conduction and colloidal assemblages—held their annual meeting last week in Washington at the Bureau of Standards. Officially these physicists, chemists and electrical engineers are known as the committee on electrical insulation of the National Research Council's division of engineering and industrial research.

The distribution engineers presented test reports which none of the expounded theories explains. Many of these test data lead to strange curves which D. W. Roper called "theme songs of dying cables." He and others showed that accelerated-life tests framed on research results lead to the rejection of good cables and the retention of poor ones.

On the other hand, research reported from the fields of physics and chemistry reflected a tendency to engage in a disclosure of the more elementary and fundamental relations of the many variables involved in dielectric response. They correspondingly placed less emphasis on tests upon the oils, papers and resins of commercial application and also displayed less tendency to propose empirical working formulas or to advance and advocate specific accelerated-life tests.

A list of most of the papers presented was printed in the ELECTRICAL WORLD for November 1 (page 809). Next November the group will meet in Cambridge, Mass., with the Harvard Engineering School as host.

▼

Submetering Again Up at N. Y. Edison Hearing

DISPUTING PRESIDENT SLOAN'S contention, as printed in the ELECTRICAL WORLD for November 1 (page 807), that submetering organizations are unwilling to go along with the united light and power companies of New York City in reducing rates, Clarence J. Shearn, counsel for the New York Real Estate Board, declared at a hearing on Wednesday of this week that his clients had not opposed reductions but that if submetering were eliminated new construction would be discouraged. He opposed approval of the demand meter, saying that installation of these meters would cost real estate owners $10,000,000, and proposed a rate drafted by Charles S. Reed, who has been employed by large power companies as an expert. The proposed Reed rate consists of a 60-cent monthly service charge plus an energy charge of 6 cents a kilowatt-hour for 1,000 kw.-hr., 5 cents for the next 2,000 kw.-hr. and 4 cents a kilowatt-hour for all in excess of that amount.

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Pennsylvania Power to Merge 28 Utilities

CONSOLIDATION OF THE PENNSYLVANIA subsidiaries of the National Power & Light Corporation, one of the Electric Bond & Share utility holding companies, is contemplated in a petition just filed with the Public Service Commission of Pennsylvania which has for its object the enlargement of the Pennsylvania Power & Light Corporation, the principal subsidiary of the company in that state.

It is proposed that the Pennsylvania Power & Light shall acquire 28 smaller utilities which have hitherto been controlled by the National Power & Light through the Lehigh Power Securities. These companies have an authorized capitalization of $6,876,700 and a bonded indebtedness of more than $7,000,000. The largest electric unit to be acquired is the Edison Electric Company of Lancaster, which has a capitalization of $4,000,000.

Court Reverses Itself on Vacuum-Tube Patents

THE UNITED STATES CIRCUIT COURT OF APPEALS at Philadelphia on November 12 ruled by two against one that the Langmuir vacuum-tube patents owned by the General Electric Company are valid, thus reversing its own action of a year ago, one judge having changed his mind after hearing the reargument. The decision is a reversal of the finding of Hugh M. Morris, former judge of the United States District Court of Delaware, who once dismissed the suit. The De Forest Radio Company, which the General Electric Company sued for infringement, will, it is thought, take the case to the Supreme Court.

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WHERE ASBESTOS LINEMEN ARE NEEDED

A pole line between Imlay City and Capac, Mich., in the northern part of the Detroit Edison territory, runs across a swamp. After a recent peat fire digging was started to replace four damaged poles. When it was discovered that far below the surface the peat was a smoldering mass that leaped into flame the poles were heavily guyed and left in the hope that they would stand until the fire was ended.

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"Public Service a Public Trust," Says Roosevelt

ADDRESSING A BOSTON meeting on Armistice Day, Governor Franklin D. Roosevelt of New York alluded to the regulation of public utilities, pointing to their monopolistic nature and professing to see "in this field of war two armies, one seeking to break down the distinctions between the utilities and the other forms of industry, seeking to free the utilities from all limitations of profit for personal gain, and on the other side that more modern army which seeks the development and distribution of these utilities at lower cost for the primary good of the great mass of the people who must have them if they are to maintain the standards of their neighbors and the civilization of today.

"Considering how recently this conflict has begun," the Governor added, "we have made greater progress than along the entire rest of the battlefront. This particular war will continue without question until general recognition is accorded to the fundamental principle that public service is a public trust."

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Would Transmit Power 400 Miles to Winnipeg

THE WINNIPEG HYDRO SYSTEM has received an offer from the British Dominions Power Company for supplying unlimited quantities of electrical energy to the city. The company has a concession to develop White Mud Falls on the Nelson River, 400 miles north of Winnipeg. It is estimated, approximately, that the site can produce 6,000,000 hp., and the offer stipulates that if a contract is entered into first delivery would be made in 1935. No price is named, but it is intimated that the power can be supplied at very low rates in large blocks, provided that the civic hydro will take delivery at the Nelson River plant, thus standing the expense of construction of transmission lines.

The concession was granted the British company two years ago and renewed for another period this year.

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Non-Essential Service Cut Off in Winnipeg

WINNIPEG IS SUFFERING from a shortage of electrical power, due to exceptionally low precipitation in the Winnipeg River watershed. At a conference between members of the provincial government, the Winnipeg Hydro-Electric Company and the Dominion Water Power Service, it was decided to cut off supplies of power for non-essential services in the hope that by this policy curtailment to industries and of power for other essential requirements might be avoided.

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New Hampshire Utilities Testify in Rebuttal

ANSWERS TO WRITTEN INTERROGATORIES submitted by the state counsel to the New Hampshire Gas & Electric Company in the investigation being conducted by the Public Service Commission of New Hampshire, in which holding-company control plays a large part, have been filed with the commission, and presentation of evidence in behalf of the utilities was begun on Monday, November 10.

John H. Logue, an accountant, was the first witness called for the utilities. He testified that the present methods of handling the business of the New Hampshire companies saved them about $300 a month in salaries alone as compared to the former method of conducting the business. Rates of the New Hampshire Gas & Electric Company, he said, have been reduced 25 per cent since 1924 on the basis of a division of the total net revenue by the total of kilowatt-hours sold. This represented a reduction of 3½ cents a kilowatt-hour, Mr. Logue said. Another statement in his testimony was that in 1929 payments of $24,115 were made to the J. G. White Management Corporation and W. S. Barstow, Inc., engineering specialists. In his opinion these services were necessary to efficient management.

Work on Hoover Dam Will Be Pushed Vigorously

To ACCELERATE CONSTRUCTION and provide relief for unemployment, the Reclamation Service of the Department of the Interior has speeded up its preparation of plans looking toward the construction of Hoover Dam, on the Colorado River, and announces that the various large contracts in that connection will be let months in advance of the dates contemplated a few weeks ago. Information has just reached Secretary Wilbur to the effect that about $3,000,000 worth of contracts will be advertised on November 15 and that as soon as the bids are in and the contracts awarded 500 men will be put to work. First necessities are roads, railroads and water supply.

The contract to supply the power necessary in carrying out the construction work at the dam has, as already recorded, been let. This line will be pushed at top speed so that it may reach the dam site by the time transportation facilities are available.

The Department of the Interior announces that it expects the specifications for the Hoover Dam itself to be ready by December 1 and that a call for bids for the undertaking will be issued at that time and the contract awarded about March 1. The first task will be to drive four tunnels, each 50 ft. in diameter and about one mile long, through the solid volcanic rock cliffs on each side of the canyon. These tunnels alone will cost from $15,000,000 to $20,000,000. Then will follow a cofferdam 80 ft. high above the site of the permanent dam and a similar cofferdam below the site, the removal of loose boulders and dirt (100 ft. to 150 ft. thick) from the drained river bed, and the construction of the great dam itself, which will be 727 ft. high, 650 ft. long at the base and 45 ft. wide at the top. The entire work is to be handled and bid for as a single project involving $60,000,000 or $70,000,000.

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Detroit Edison's Two New Turbo-Generators

WITH THE GENERATING CAPACITY that has gone in since midsummer in the country at large—exceeding 1,000,000 kw.—as tabulated on page 798 of the ELECTRICAL WORLD for October 25, should be included 60,000 kw. added by the Detroit Edison Company—a 50,000-kw. unit (No. 6) at its Marysville plant, turned over for the first time on the last day of September, and the 10,000-kw. British Thomson-Houston superheat unit started up at Delray No. 3 on the following day.

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Washington G. & E. Buys Long-Bell Plant

PURCHASE OF THE POWER PLANT of the Long-Bell Lumber Company at Longview, Wash., by the Washington Gas & Electric Company, after negotiations of several months, is announced. The electric company, which holds the electrical franchise for Longview, has been purchasing its power from the lumber company. The sale contract provides that the lumber company will buy its power from the utility company. Fuel for the boilers (partly sawmill refuse) will continue to be supplied by the lumber company. The Long-Bell power plant was placed in operation in July, 1924.

Municipal Ownership Issues in Ten States

BY NEARLY FOUR AND A HALF TO ONE, the citizens of Salem, Ore., at last week's election instructed the City Council to proceed with steps necessary to the acquisition of water from Marion Lake for municipal power purposes. (ELECTRICAL WORLD, October 25, page 763.)

Portsmouth, Ohio, last week defeated by 5,700 votes a proposal to establish a municipal electric plant to compete with the Ohio Power Company. The proposal of North Baltimore, Ohio, to build its own electric distributing system was defeated by 20 votes.

Froelich & Emery, consulting engineers of Toledo, Ohio, recently submitted a report to the officials of Sandusky, in that state, indicating that a municipally owned electric light plant could not be successful.

Floyd L. Carlisle, chairman of the board of the Niagara-Hudson Power Corporation, assured the Watertown (N. Y.) City Council last week that the Northern New York Utilities would renew the contract for the city's surplus power, which expires in a year and a half, and possibly reduce domestic rates. Mr. Carlisle asked the councilmen to wait before putting the city's plant into the commercial lighting field, and it is thought that they will comply with his request.

Voters of Terrell, Tex., have just defeated the proposal to sell their municipal light plant to the Texas Power & Light Company by 834 to 361. The power company offered to pay $450,000 cash for the plant and distribution system.

In Oklahoma the city of Woodward is suing to recover possession of its

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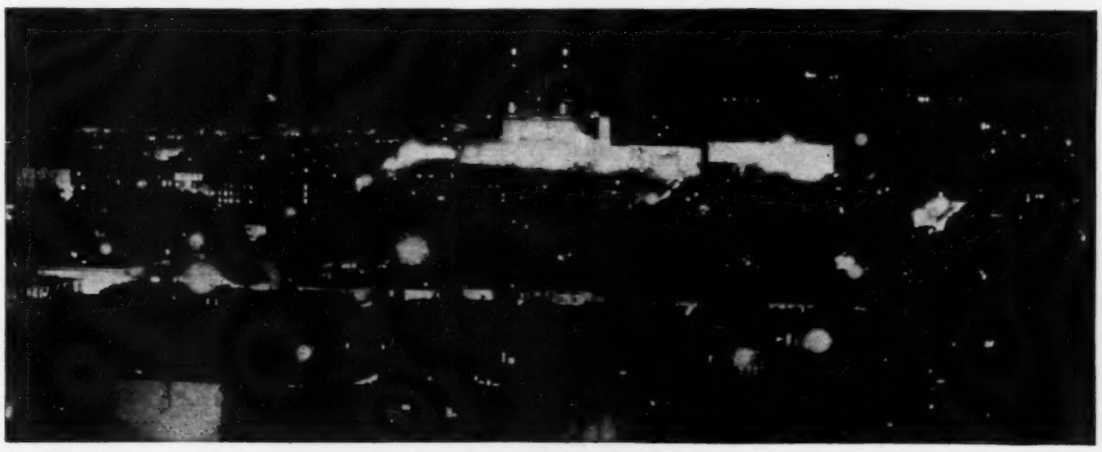
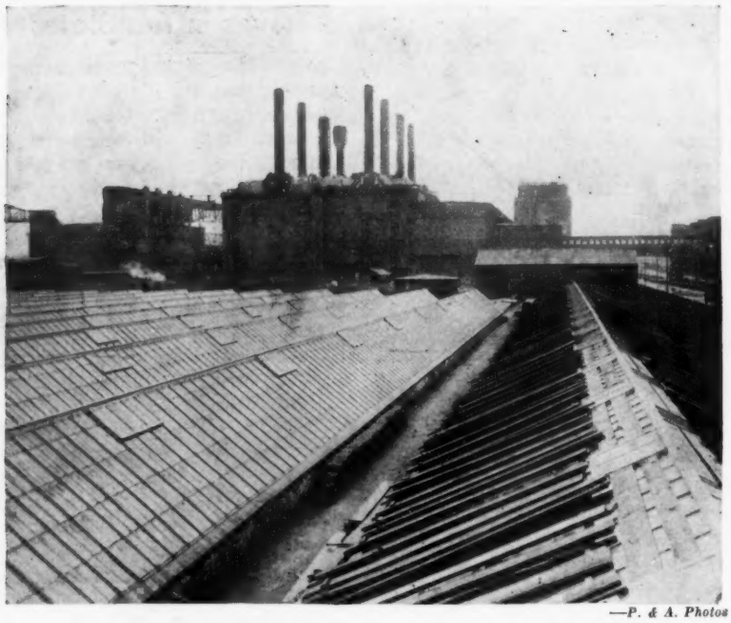
SAN FRANCISCO CHURCH CELEBRATES DIAMOND JUBILEE



St. Ignatius' Church and University, San Francisco, marked a recent notable anniversary in its history by a brilliant exhibition of floodlighting

POWER STATIONS AND CUCUMBER CULTURE



—P. & A. Photos

In Germany hothouses are sometimes found in the immediate vicinity of generating stations, which supply them with heat, hot water and electric light and power. A rich harvest of cucumbers is gathered from the structures shown here, which are just behind the Kraftwerk Klingenberg of Berlin.

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power plant, which by a vote of 749 to 654 was two years ago transferred to the Western Light & Power Corporation of Salina, Kan. The petition charges "fraud, corruption and bribery" and holds that the price, $505,000, was inadequate. Failing decision in its favor, the city asks for powers of condemnation and repurchase.

Mass meetings of citizens have been held at Paris, Ky., recently to discuss plans for a municipally owned light, power and general utilities plant. This movement is being fought by the Kentucky Utilities Company, which desires a renewal of its expiring franchise. The agitation is due in part to the long drought, which has been virtually unbroken since last spring in parts of central Kentucky, especially at Paris, Lexington, Shelbyville and Richmond, and has caused dissatisfaction with the company's water service.

Lawrenceburg, Tenn., has received another offer from the Tennessee Electric Power Company to purchase the municipal light, power and water properties. The power company offers $247,000 in cash and the assumption of $328,000 of the bonded debt of the city, conditional on certain legislation being passed. If the conditions are met and the offer accepted, the sale will be effective on February 15 next.

A compromise has been effected in the case of the City of McKenzie vs. the Kentucky-Tennessee Power Company, in which the muncipality sought to regain possession of its power plant. By the agreement McKenzie is to be paid an additional $25,000 for the property, which was purchased a year or more ago for $79,000.

The city of Goshen, Ind., has closed a contract with Fairbanks, Morse & Company, Chicago, for equipment to be placed in the municipal electric plant at a cost of $238,000. For eleven years the city, which owns its distribution system, has been buying energy from public utility companies on contract. "Unalterable opposition" to the new plan is expressed by the Goshen Manufacturers' Association, which holds that the Interstate Public Service Company now offers a contract more favorable to consumers.

The City Council of Richmond, Ind., recently, following much controversy, declared that it was "through with standby service" and would develop the city-owned utility by the purchase of additional equipment. Both the proponents and opponents of standby service are said to admit that the public as a whole is opposed to a standby contract, though the majority of manufacturers and business men favor it.

The Austin (Minn.) City Council has rejected an offer of the Interstate Power Company to purchase the municipal plant for approximately $1,000,000. The municipal power plant at Thief River Falls, Minn., is being enlarged by another engine, voters having approved a bond issue for the purpose.

The City Council of Moberly, Mo., has authorized a survey for a proposed municipal light and lower plant and distribution system. The franchise of the Missouri Power & Light Company expires the first of next year. The company is expected to seek a renewal.

St. Louis engineers have submitted to the city officials of Vinita, Okla., plans for a municipal light and power plant and distribution system to cost approximately $240,000.

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San Joaquin Company to Build Steam Plant

CONSTRUCTION OF A 50,000-KW. STEAM PLANT at Herndon, on the San Joaquin River, about 10 miles north of Fresno, Calif., will be begun immediately by the San Joaquin Light & Power Corporation, controlled by the Pacific Gas & Electric Company, A. Emory Wishon, president of the San Joaquin company, has announced. The plant, to cost about $4,610,000, will burn natural gas from the Kettleman Hills, which will be piped through a 12-in. main from Fresno. Work will continue over a 20-month period, June 1, 1932, having been set as the date for completion. Adjacent to the steam plant a new substation will be built.

At the same time construction will be started on a 100-mile 220-kv. transmission line, which will extend from the Herndon plant to Bellota, a point about 60 miles north of the Great Western Power Company's Wilson substation. At Bellota the new 220-kv. line will tie in with the Pacific Gas & Electric Company's system. The line will cost about $2,000,000.

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Port Washington Station Plans Meet Approval

APPROVAL BY THE WAR DEPARTMENT of plans of the Milwaukee Electric Railway & Light Company to widen Port Washington Harbor and construct a large coal dock as part of its power-plant project have, according to S. B Way, president of the company, removed the last obstacle in the way of prosecuting the work and enabled completion of plans deferred because of previous uncertainty. This contemplated plant, which will have an initial capacity of 75,000 kw. and an ultimate rating of 300,000 kw., will involve an early expenditure of $8,000,000 and a prospective cost of $25,000,000.

Chamber of Commerce's Water-Power Referendum

A REFERENDUM ON NATIONAL water-power policy is being taken by the Chamber of Commerce of the United States. Voting on fifteen recommendations made by a special committee which has been engaged in a study of the subject for more than a year and submitted to 1,600 member organizations of the National Chamber will close December 22. The recommendations follow:

That federal and state appropriations should be increased for the collection and publication of data relating to water resources.

That the federal government should leave to the states all possible control over utilization of water resources in the states.

That each state should have an agency to promote and regulate development of its water resources.

That the states should use compacts among themselves for determination of their respective rights in boundary and interstate streams.

That, through adequate appropriations and through methods of appointment and compensation for members and staff, state commissions should be enabled to discharge their duties with the greatest possible efficiency.

That state commissions should be authorized to initiate proceedings in which they may exercise their regulatory powers, including proceedings as to disparities in domestic rates.

That every effort should be made by regulatory bodies and utilities to reach by agreement the valuation to be placed on properties used for public service.

That interstate power, so far as now incapable of regulation by states, should be regulated through concurrent action of state agencies made effective by the Federal Power Commission, and only in the event of the failure of concurrence on the part of the state agencies should be regulated directly by the Federal Power Commission.

That municipally operated utilities should be subject to the same regulation as privately operated utilities.

That the Federal Power Commission should avoid duplication by utilizing the field services of other agencies of the federal government.

That development and distribution of electric power is within the proper sphere of private enterprise.

That the federal government should leave the construction of dams and other structures and the generation of power to other agencies, except where they are an essential part of national or international projects that cannot be successfully carried out by other agencies.

That the federal government should always leave the transmission and distribution of power to other agencies.

That the state governments should leave development and distribution of power to utilities which they effectively regulate.

That the Muscle Shoals project should be sold or leased as it is, on the best possible terms.

Frederic A. Delano, member of the Federal Reserve Board, Washington, is chairman of the committee. Among its eleven other members are Lafayette Hanchett, chairman of the board, Utah Power & Light Company; Horace W. King, professor of hydraulic engineering, University of Michigan, and Lewis B. Stillwell, consulting engineer, New York City.

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Coming Meetings

American Institute of Electrical Engineers — Southern District, Louisville, Nov. 19-22; winter convention, New York, Jan. 26-30. F. L. Hutchinson, 33 W. 39th St., New York.

American Society of Mechanical Engineers—New York, Dec. 1-5. C. W. Rice, 29 W. 39th St., New York.

Pacific Coast Electrical Association—Engineering Section, Los Angeles, Dec. 10-12. S. H. Taylor, 447 Sutter St., San Francisco.

American Engineering Council—Annual meeting, Washington, D. C., Jan. 15-17. L. W. Wallace, 26 Jackson Place, Washington.

North Central Division, N.E.L.A.—Commercial meeting, Nicollet Hotel, Minneapolis, Jan. 26 and 27; engineering meeting, same place, Feb. 23 and 24. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Midwest Power Engineering Conference — Chicago, Feb. 10-13. G. E. Pfisterer, 308 W. Washington St., Chicago.

Oregon Merchants Protest Against Utility Sales

HEARING IN THE COMPLAINT filed last March with the Oregon Public Service Commission by the Oregon Merchants' Utility Bureau against the merchandising practices of the public utility companies of the state will probably be held this month. The petition prays that the commission will order the electric and gas utilities to render to the commission uniform accounts of their operations that will reveal methods, expenses, costs, profits and loss in merchandising and jobbing deals, as a preliminary to the issuance of suitable orders.

The complaint states that the petitioning merchants' bureau represents more than a score of resident organizations engaged in the sale of electrical and gas appliances, that the utility companies have created a "confusion of activities that does violence to the real spirit of regulatory laws," and that the practice "results in a vicious destruction of mercantile competition and affects the cost of service to the general public."

The point of attack is the accounting practices of the public utilities. It is contended that the methods in use do not accurately portray actual conditions and violate the commission order on uniform classification. Through a thorough investigation of these practices the petitioners hope to cause the commission to order a complete segregation of merchandising from the rest of the utilities' business.

OUT FROM THE SHADOW

The statue of General Robert E. Lee in Lee Circle, New Orleans, which had stood in darkness each night since 1883, is now boldly silhouetted against the sky. The dedication of the floodlighting system took place on October 20. W. E. Clement, New Orleans Public Service, Inc., was chairman of the Electrical League committee which initiated the idea.

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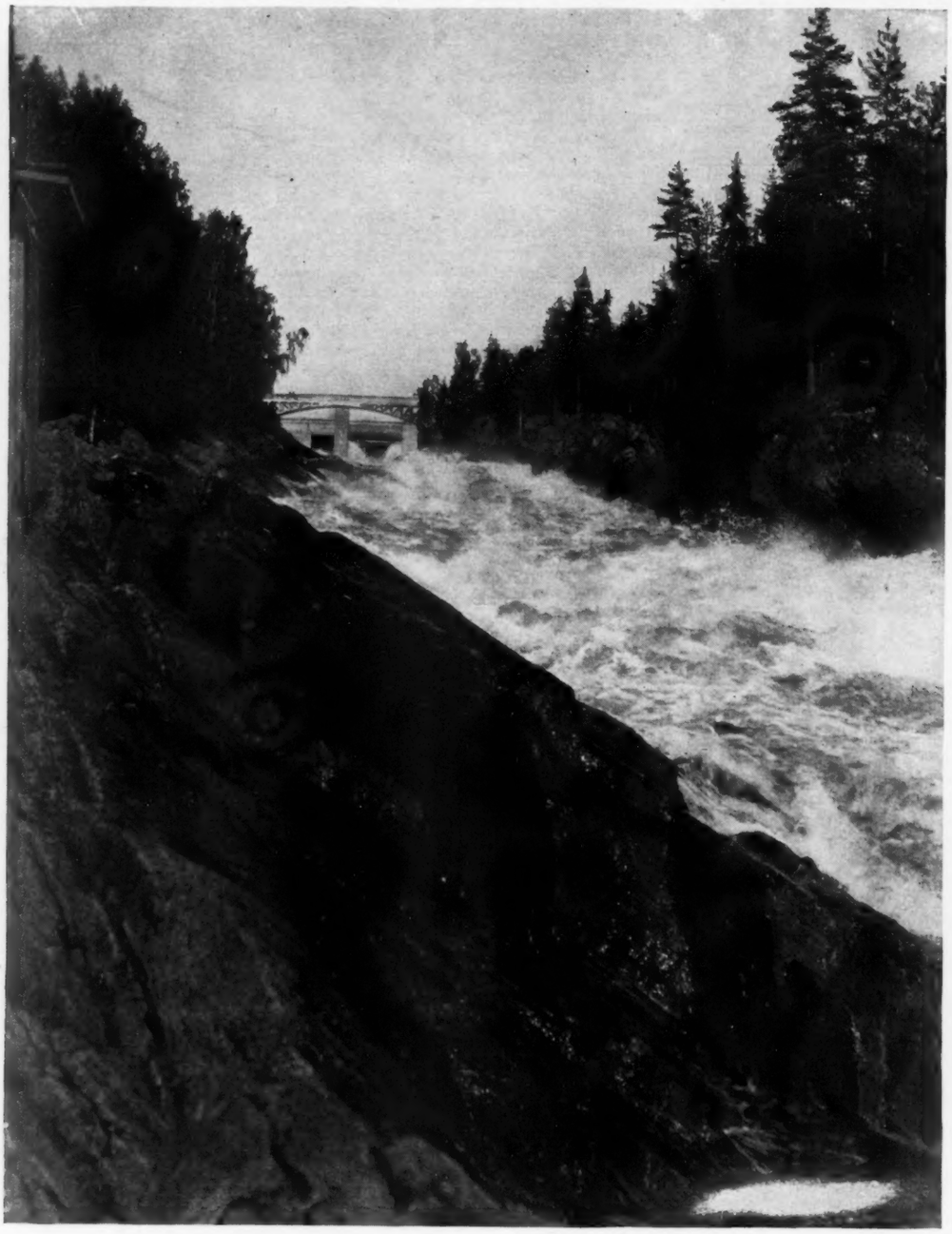
Sale of Hydro Plant at Franklin, Mass., Approved

SALE OF THE BOSTON & MAINE Railroad's 2,272-hp. hydro-electric plant on the Pemigewasset River at Franklin, Mass., to the Public Service Company of New Hampshire for $600,000 has been approved by the New Hampshire Public Service Commission. Certain flowage rights and a 22-kv. transmission line to the Concord city line are included. Under the agreement the railroad company will obtain for ten years 3,500,000 kw.-hr. annually from the Public Service company at a price of 1 cent a kilowatt-hour, which is at least 0.5 cent less than the cost at which the railroad company can produce energy at the plant. The plant will probably be enlarged to fit better into the Public Service company's network, at a cost of $525,000.



IMATRA FALLS

One of Newest Finnish Plants

While possibly 2,500,000 hp. is available from water power in Finland, only about 345,000 hp. is so developed, and steam plants are used to a greater extent than might be expected because they can be located nearer load centers, because waste wood and British coal can be delivered directly by ships, because hydraulic heads average only 12-24 ft. and seldom over 90 ft., and also because of ice difficulties. Of the 1,333,000,000 kw.-hr. used for power in 1928 about 60 per cent was generated by water power. More than 900,000,000 was used for wood-product plants. Textile and steel mills also figure as power users. The Imatra Falls plant, with a head of 72 ft., is one of the newest hydro stations and transmits power at 120 kv.

EDITORIALS

L.W.W.MORROW
Editor

Utilities and the election

CRITICS of the "power trust" and of present methods of utility regulation were placed in the saddle by popular vote last week. Oregon and Washington are committed to public ownership of utilities as state policies. Pinchot, Roosevelt and other newly elected governors have positive programs for changes in utility practices. Candidates who dared defend the utilities were microscopic in numbers and non-successful in their campaigns. The election marked an added stage in the attempts to socialize the light and power industry.

It will be granted that the election does not make likely much prompt and tangible action subversive to utilities or to present methods of regulation. Congress and the legislatures must be considered, and the courts are available to overthrow illegal moves. Time and more elections will be required to make radical programs actualities. But sufficient straws were thrown into the wind to indicate a very positive trend that should call for thought and action. If there is no rectification, a great industry will be injured or stifled and, what is more important, this country will not continue its electrical developments on the scale witnessed in the past.

The light and power industry should not be socialized. It does not merit condemnation by the public. It has an unrivaled record of achievement in public service and in business enterprise. It has a sound business and service philosophy and a program for future service and growth that will be invaluable to the public and to material progress. Yet it is in disrepute as a national institution and the blame rests very largely upon its own shoulders. Part of its task is to conduct its affairs so that it will win public approbation and not public condemnation. Utility management has failed to measure up to this responsibility, even though management sins were more those of omission than those of commission and were natural and understandable.

The important thought is that sins of omission and commission should be absent in the future. What the light and power industry faces today is analogous to what the telephone industry faced ten years ago, and there is every reason to believe that the intelligence and knowledge exist in the electric ranks to build the sound public relations that were built by the telephone interests. We believe this will be done and that progress will be rapid enough to prevent injurious actions being anywhere taken by reason of the recent election. The industry should marshal its leadership immediately for developing a positive and workable program for improved public relations. This program should measure conditions within the industry with the same precision as conditions without the industry and should be applied persistently and courageously.

Oregon and Washington vote public ownership

DEALING a staggering blow to the electric utilities of Oregon and Washington, both these states passed so-called district power bills by substantial margins in the election of November 4. The measures are similar and authorize the creation of public utility districts with power to issue bonds and to condemn and take over all plants and property now supplying electrical energy in those states. Administration of the districts would be in the hands of a commission of

three in Washington and of five in Oregon, with almost unlimited powers. The measures are without question the most sweeping legislation affecting public utilities ever passed by any state. In their sweeping nature lies, indeed, their greatest weakness. Even in the face of the state-wide popular vote, it is still hardly conceivable that political subdivisions will vote to place themselves at the mercy of these commissions with their broad bonding and taxing powers.

Passage of these bills does not, of course, mean that the entire states of Oregon and Washington are immediately going to state ownership. It will be a long-drawn-out and hard-fought process. Public utility districts must be set up and bond issues passed by a vote of the people, and each attempt to create a district will be an issue in itself. Seattle and Tacoma have long wanted to expand their systems to cover western Washington, and undoubtedly they will be the first to take advantage of the new legislation.

If the experiment to be conducted by these two states proves as great an economic lesson to the rest of the country as did the socialistic experiment of North Dakota, then at least some good may result.

Armorclad gear finds favor

ARMORCLAD switch and bus structures will cost less and less as their use expands and manufacturers are enabled to reduce them to mass-production units. Even today in some localities where labor costs are comparatively high there is definite economy in the installation of factory-assembled structures of the armor-clad type as compared with the familiar open-cell construction.

It is to be expected that local labor will not look with favor on this development. There will be clamorings and outcries. This condition prevails when any new thing in mechanics, any invention, any scientific discovery that has been applied to industry, has caused the elimination of labor. These things are not to the ultimate disadvantage of labor. To face the facts fearlessly and openly is the duty of both the employer and the employed. The steadily rising investment costs of central stations make it imperative that every new thing that promises to decrease the investment shall be fostered and encouraged. It is less than five years since metal-clad gear was introduced into the United States, but already it has proved that it does hold such promise. It will find its economic pace in the industry, whose normal trend is to use more and more labor as its services and facilities expand.

The price that's paid for lack of market knowledge

NO MAN who drives a motor car but stops to marvel now and then at the perfection of this triumph of human ingenuity and science. How can so complex a mechanism be made so utterly efficient and dependable? The answer is plain to any one who wants to spend a day in the General Motors research laboratory and proving grounds. There each year a million and a third dollars is being spent in laboratory tests and research and a half a million dollars in driving cars over the road to discover weaknesses and to evolve improvements. This price is paid for courage in facing facts, and it is a miracle of modern mass production that such exhaustive knowledge can be actually obtained at a cost of not more than a dollar and a half a car.

The electrical industry has seen no less an accomplishment in the fields of pure science and engineering research through the last decade. There has been a comparable contribution to industrial and social progress. But need the orderly pursuit of facts and the methodical analysis of values be restricted to the realm of engineering and science? What of the economics of the business and the experiences of marketing? Is precision and accuracy based on proven facts any less important and valuable in developing the use of electricity than in its generation and distribution?

For several years now the leaders of the power industry have preached the vital need for building load and for load-factor improvement. They are entirely right. It is the problem of the hour. For the further growth of the electrical business in all its branches waits today on the increase of per capita consumption of energy by a more nearly universal use of more complete equipment in industry and commerce and in the home. But this

will happen only when electrical men make it happen by their more intelligent and effective selling.

It is time the industry sat back and asked itself: "What proven knowledge have we in the marketing of electricity?" For there is seen about the country an infinite variety of commercial policy and practice. Which is right? Which of the new ideas now under trial are best? How is the industry going to know? Knowledge will only come as it has come in making motor cars, by comparing, analyzing and evaluating experience, by selection and correction, and by paying the price. But by organization these results can be made as sure as in the laboratory. And it costs more not to know.

Photo cells versus observation towers

IN BERLIN an observation tower is maintained in connection with the street-lighting organization, and from it when natural lighting becomes insufficient signals to turn on the street lights are sent to various control points. This has been considered necessary because the customary means of automatic street-lighting control are based on schedules which take cognizance of only the rising and setting of the sun. In this country the observation-tower idea has been used by utilities primarily for another purpose—to warn the system operator and through him the station operators of approaching peak loads. At the same time the system operator can notify substation operators to turn on street lights within their control.

This raises the question why photo cells should not have more consideration as street-light and electric-sign controllers. Of course, they have been applied to these purposes and also to interior lighting to a limited degree—but why not more? Pedestrians and drivers alike would benefit from the immediate response of street lighting to inadequacy of daylight. Owners of electric signs would receive a larger return from the investment they have made in such advertising. Employers would be relieved from the drop in efficiency of workers when natural light becomes inadequate. These public benefits should provide a full return for any profit which utilities and manufacturers might derive from such installations.

Business perspective on water power

MANY a business man has doubtless been perplexed by the hubbub that surrounds the nation's effort to develop a water-power policy. In his diversified reading he meets discordant estimates of the water-power resources of various rivers and regions. Why do they differ and what agencies assemble them? He may even wonder why all the water power is not developed without delay. Can it be possible that burning coal is cheaper than utilizing nature's gift of elevated water?

Locally he has had his attention drawn to the state's regulation of the vending of the electric service. He may wish he knew more of the background of this governmental scheme of control, its inception, philosophy and limitations. What has brought the federal government into the picture? Is it pure political opportunism or are there valid grounds for the intrusion, and how far must state regulation yield because of its inadequacy? And this Federal Power Commission—what has been its scope and what is the Congress contemplating as to the enlargement of its delegated powers? Maybe our business man also wishes he knew in terse and concise fashion the facts about Muscle Shoals and fertilizers, about Boulder Dam and irrigation.

All these points are admirably summarized in compact and lucid manner in a report just issued by the national water-power policies committee of the Chamber of Commerce of the United States. Representative as it is of all commercial enterprise of the country, its committee tries to speak absolutely without bias and it recites the salient facts in such manner as to show the confluence of these controversial elements of private and governmental business into a stream that itself must be directed into proper channels if the nation's water-power policy is to be sane and forward-looking. Congress will perforce be constrained to adopt the soundest policy rather than the most politically expedient one if every business man reads the report of his national organization as a preparation for later reading of the recommendations to be made with regard to a coherent national program.

FORD FORGES with Electric Heat

IMPRESSIVE evidence that electric heat is entirely practicable for forging operations is afforded by just one glance down the 640-ft. aisle of the spring and upsetting building of the Ford Motor Company's Rouge plant. As far as the eye can see electric furnaces alternate with upsetting machines to the number of 55 units like the multiple images of an object between facing mirrors. At the time this striking sight was observed, 32 furnaces lined one side of the aisle and 23 the other side, but the total number is not likely to remain at even this remarkable figure if the contemplated production policy is carried out. There are plenty of fuel-fired units in operation, too, but their number is likewise unfixed because one by one they disappear from the production line. The fact that these electric units have been installed to augment the well-known economy of Ford production methods adds additional significance to their number.

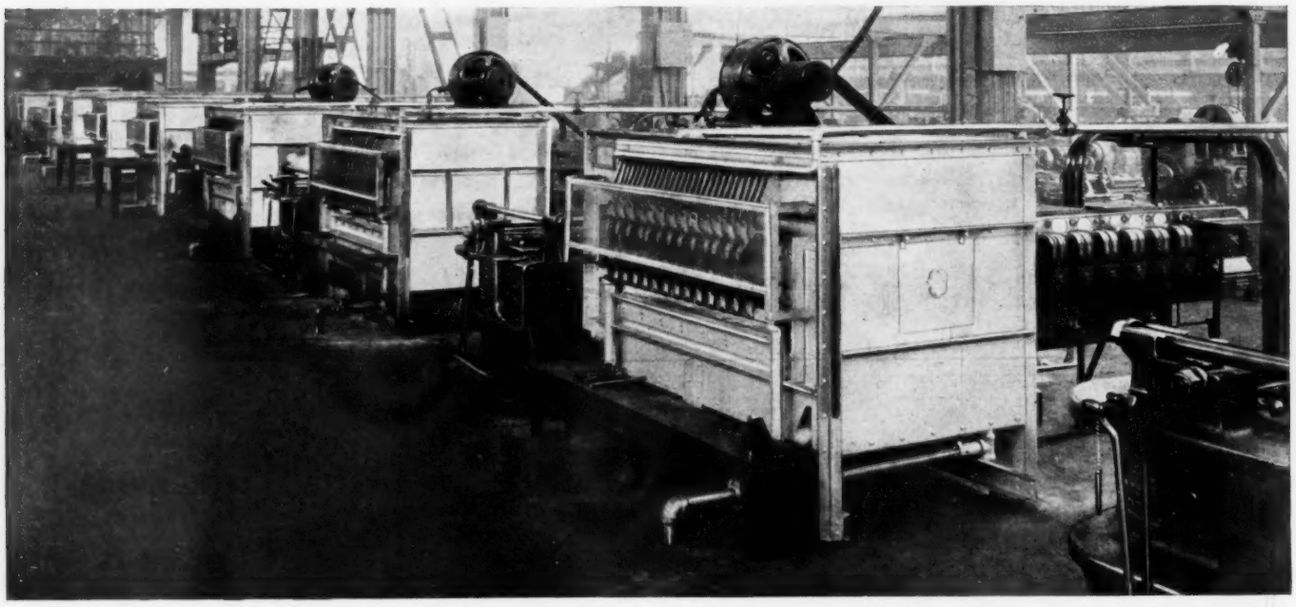
Aside from this major impression, a mere observer cannot avoid sensing the simplicity of the electric furnaces, the small space occupied, their convenience to production machines, the absence of fumes and depressing heat, and the lack of necessity for manual adjustment.

At present the electric furnaces are used for heating only comparatively small forgings, universal joint housings, front wheel spindles, steering gear spiders, ring gears, rear axle shafts with forged gears on their ends, and the like. Larger pieces, such as crankshafts and front axles, are still heated in fuel furnaces, but it is anticipated, when the generator capacity now being added to the Ford power house is available to carry the increased load, that these operations also will be performed with electric heat.

Temperatures necessary for forging steel vary from 1,900 to 2,450 deg. F. Most of the work in the Ford plant is heated to 2,300 to 2,350 deg. This range lies between the maximum of about 1,900 deg. F. for the commercial metallic resistor type and the lowest practicable operating temperature of the arc furnace. In this intermediate range the carbon trough resistance furnace was the first developed and a number of these are in use in the Ford plant.

While the carbon trough furnace is an adequate and economical performer in large installations that are run continuously for long periods, it has certain disabilities that make it undesirable in the smaller units that are necessary in automotive production lines. The carbon furnace is a low-voltage device and each unit must have a transformer. It requires from ten to twelve hours to reach forging temperatures. Thus, for small units in more or less intermittent operation, both the first cost and the operating cost are fairly high.

Carbon trough and rod type electric furnaces



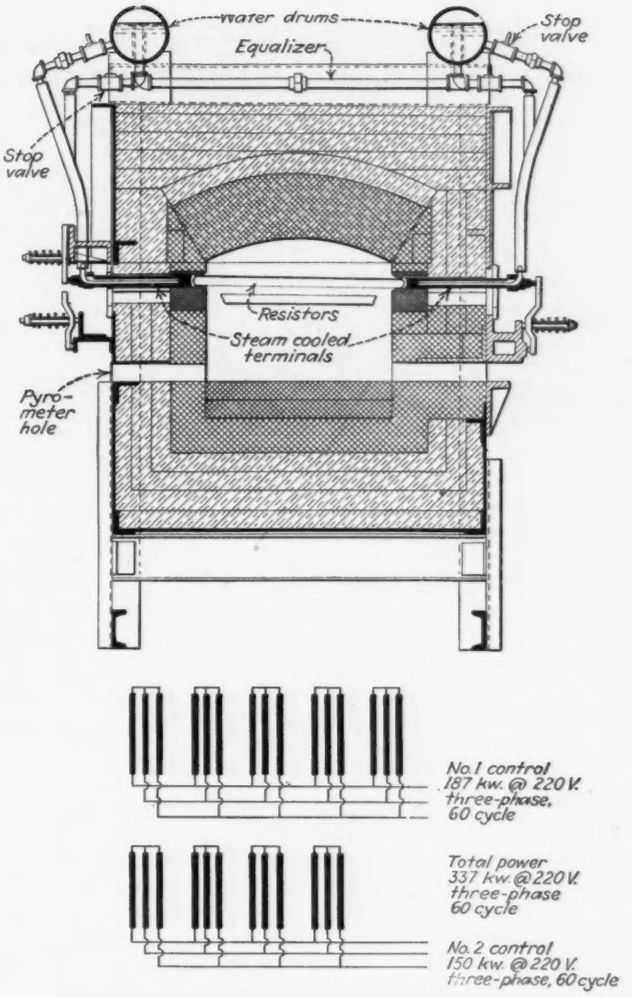
Therefore when the rod resistor, operating at surface temperatures up to 2,450 deg. F., was developed it apparently found a field ready and waiting for it. These rods are of silicon carbide, to which is added in manufacture certain other materials to act as a binder and to provide the desired conductivity. Since the rods are designed to be worked at ordinary utilization voltages the need for a transformer at each furnace was removed, and because of their small mass the heating-up period was reduced to much less than an hour. For these reasons the rod resistor furnace is superseding the carbon trough type for ordinary forging operations.

The simplest type of furnace of this kind is merely a sheet-steel or cast-iron shell with insulation and fire brick lining. The resistance bars are spaced across the top of the interior and their terminals brought out through ports in the sides. A slot, 2 to 4 in. in height, running lengthwise on one side, allows the work to be placed in the furnace. Other forms providing for continuous passage of material by means of conveyors, pushers or walking beams are only modifications of this basic design.

A difficult problem in the first rod-resistor furnaces was terminals. It was early discovered that the terminals would have to be cooled and, of course, water was first used. The terminals were made of pipe with a welded chrome-iron cap, recessed to hold the rod end. This worked out very well except that it used a considerable quantity of water and sometimes the water tubes would plug up. A later development is to steam cool the terminals by means of a syphon system, including a pair of water drums on top of the furnace.

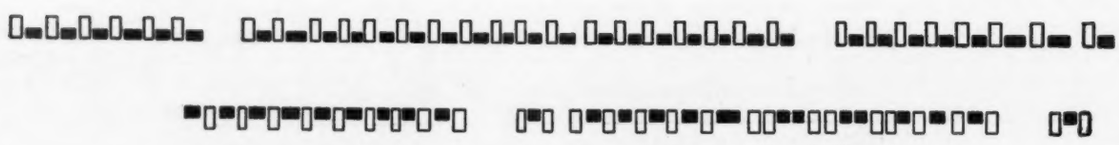
The larger number of these furnaces in the Rouge plant are rated at 337 kw., 220 volts, three phase. In each are nine groups of three star-connected rods. There are two control sections, one rated at 187 kw. and containing five of the stars and the other at 150 kw. containing four. Control is effected by cutting the sections in and out. The groups in the two sections are alternate in location, so that control is even along the length of the

alternate in the same lines with forging machines


Water drums
Equalizer
Stop valve
Stop valve
Resistors
Steam cooled terminals
Pyro-meter hole
No.1 control 187 kw. @ 220 V. three-phase, 60 cycle
Total power 337 kw. @ 220 V. three-phase 60 cycle
No.2 control 150 kw. @ 220 V. three-phase, 60 cycle

Features of resistor-rod furnace

This cross-section of a rod type 337-kw. furnace shows the general features of design, among them the simplicity of the electrical connections. The resistor rods are held in compression against the recessed ends of the steam-cooled terminals.



Electric forging furnaces alternate with upsetting machines

These platoons of electric furnaces and upsetting machines, the first solid black and the second open, rectangles, give an idea of the size of the Ford installation. The longer row extends over 640 ft. and contains 32 furnaces and the same number of upsetting machines.

furnace. The control consists of a recording pyrometer with contacts operating the section air breakers. On some of the furnaces there is an auxiliary pyrometer contact, added by the electrician in charge of the furnaces, which, in case a breaker should stick, actuates visible and audible alarm signals. Other furnaces of this type in the Ford installation run up to 540 kw., but the general features of design and control are the same for all of them.

The size of these furnaces, most of them 5 ft. 6 in. by 2 ft. in plan, is an important consideration in this, as in any other mass production, installation. The floor area required for the electric furnace is about half that necessary for an oil- or gas-fired unit. The compactness of assemblage of furnaces and forging machines thus permitted on the floor is evident from the illustrations.

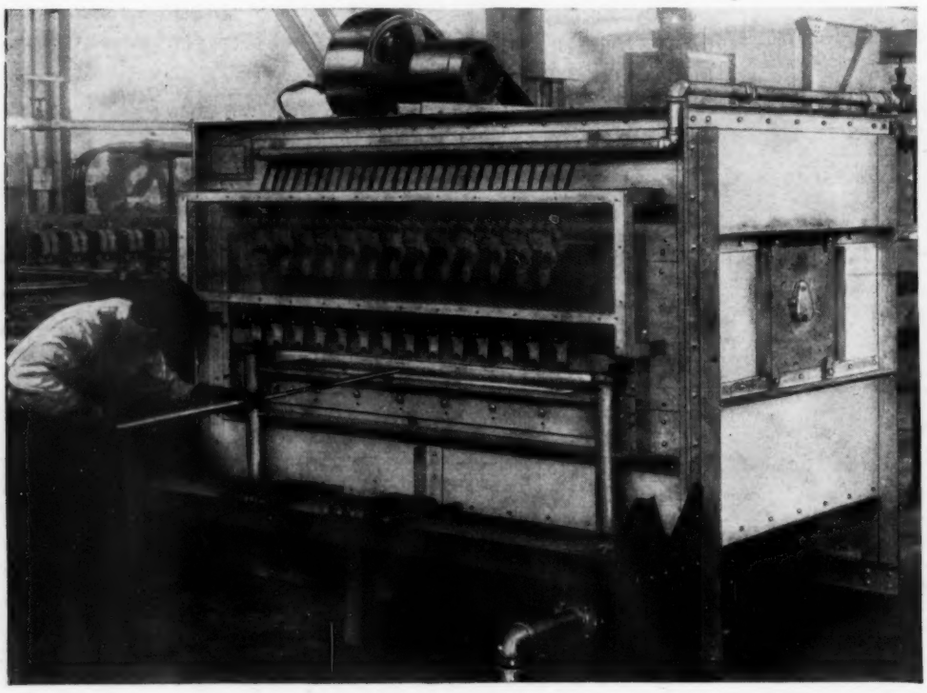
The furnace in operation

The 337-kw. furnaces have each a capacity of 900 lb. of metal brought up to 2,350 deg. F. per hour. It is difficult to make any exact statement of performance economy, but a reasonable average figure would be in the neighborhood of 4.75 lb. per kilowatt-hour for bar heating. Three units rated at 540 kw. used for heating flat bar stock, which is bent and welded into blanks for ring gears, have each a capacity of 150 bars per hour. The bars weigh 13.4 lb. The comparatively higher work capacity of these furnaces is due to the fact that the stock feed and travel through the heat are automatic and the temperature is 2,100 deg. F., which provides a somewhat less intense heat than that employed in the other forging units.

The electric forging furnace has several labor advantages over the fuel fired. Neither one requires highly skilled labor, but the latter does need an operator sufficiently trained and experienced to judge temperatures and to keep the furnaces properly adjusted under changing conditions of operation. With the electric furnace no training is required; all that is necessary is that the operator shall remove the stock in the same sequence as he put it in.

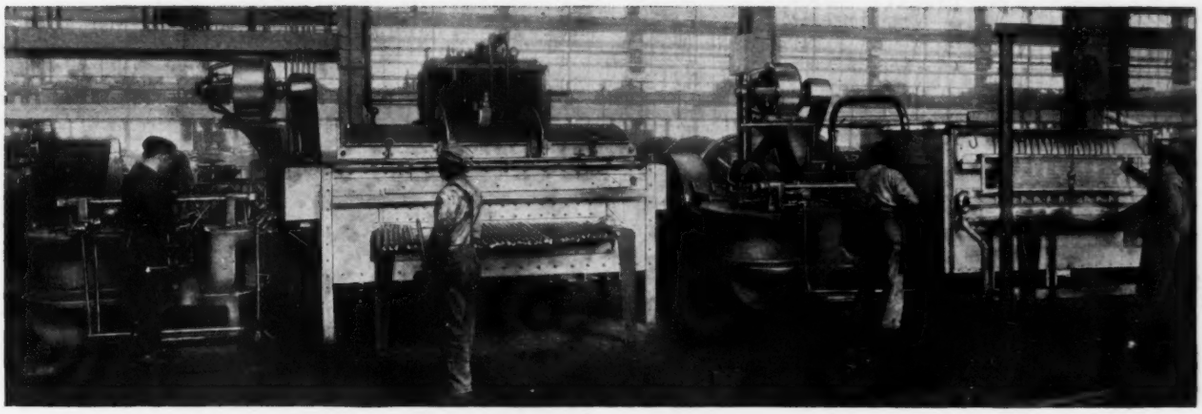
Since labor costs are directly affected by working conditions, the electric unit has a great advantage in this regard. The furnace is, in effect, only another machine, not an inimical entity from which protection must be found in air jets, screens and shields. Because of its freedom from flames and smoke belching from its mouth, because it does not greatly heat up the air around it, the electric furnace becomes a really continuous producer, not an intermittent one like some fuel-fired units, whose operators must frequently take time out to gasp for breath and to cool off.

It can be said that the ordinary operation of the electric furnace is equal to exceptionally good operation of the fuel fired. The ideal of perfect operation which results in no rejects in product can be approached with both types, but more easily with the electric furnace. The rod resistor unit, which may not be operated at a temperature



Just like another machine

The cleanliness of the electric forging furnace and the comfort it allows to the operator are apparent here. Neither direct nor reflected heat is largely in evidence and the workman needs no other protection than leather gloves for handling the tongs.



Two types of electric furnaces used

of more than 2,450 deg. F., allows no chance of excessive overheating: in the electric furnace there is no possibility of the free carbon which had collected on the ceiling of the chamber falling down and burning the work, nor opportunity for gases in the nascent state to combine with it. There is probably more scale on the metal that comes out of an electric furnace, but it is free, less in combination with the metal surface and is more easily removed.

Dies, which are an important element in the cost of forging operations, last longer on metal electrically heated. Records have shown maximum die life of 1,800 to 2,000 operations on fuel-heated metal, while 2,500 operations is not uncommon in the same upsetting machine taking electrically heated stock. Some of the reasons for this difference are obscure, but probably they are associated with more uniform heating and a smoother gradient of temperature rise in the structure of the metal. An obvious reason for the longer die life is that the scale on the electrically heated stock is not burned into the surface of the metal and may be entirely removed before the steel is placed in the die.

An outstanding feature of the rod-resistor type of furnace is its ease of maintenance. A broken rod may be replaced in about twenty minutes without shutting the unit down. The average life of rods is rather indefinite, but about 900 hours would be a conservative estimate. In some cases rods have lasted very much longer, but this figure represents an entirely adequate performance and may be accepted as an under- rather than an overstatement.

Maintenance is easy

Associated equipment, as breakers, relays, instruments and such, in the control arrangements requires the same maintenance care in this application as in any other. Because of its greater cleanliness the electric furnace does not impose on neighboring machines nor on the building itself as high a maintenance cost as does the fuel-fired unit.

And now, to sum up the testimony, it has been shown that the rod-resistor electric furnace is occupying a rapidly growing place in the forging operations of the world's greatest production line; that it puts out a better product, and that its direct and associated maintenance is less.

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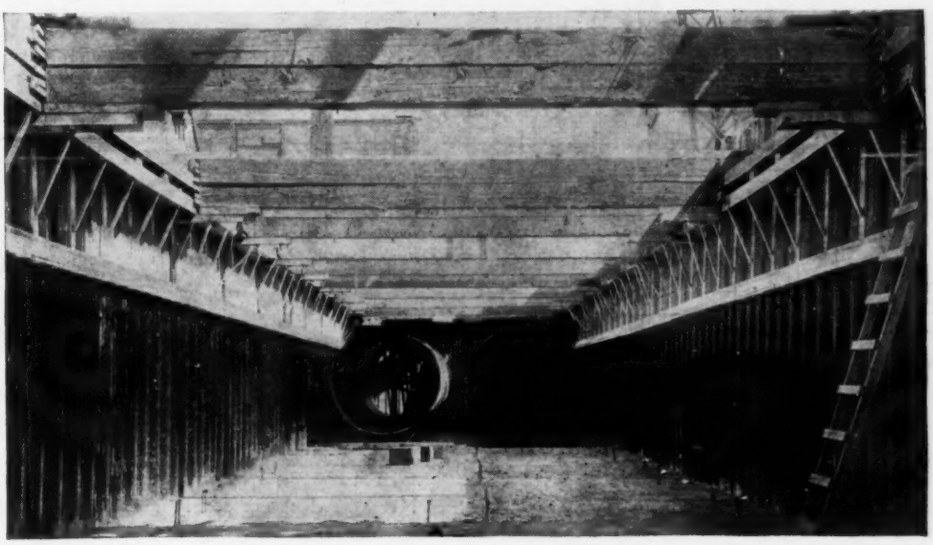
Pipes for Tunnel Forms

Instead of using wood forms to construct the concrete circulating water tunnels at the Powerton station of the Super-Power Company of Illinois comparatively thin walled pipes of welded steel were set in the tunnel excavation and the concrete poured around them. These pipes remain as tunnel liners.



Chlorination Prevents Slime Fouling of Condensers

Adhesion of slime to condenser tubes and the consequent decrease in the condenser vacuum and rate of heat transfer may be prevented by chlorination of the circulating water, according to the N.E.L.A. prime movers committee report. That fact was proved by experiments conducted by the Northern Indiana Public Service Company and by the Public Service Electric & Gas Company.

The East Chicago power station takes its circulating water from the Grand Calumet River, which is so contaminated by both industrial and domestic sewage that it has the following chemical analysis:

	Parts per Million
Total solids	354
Silica	12
Iron hydroxide (suspension)	308
Calcium sulphate	56
Calcium carbonate	87
Magnesium carbonate	115
Alkali chlorides	5
Nitrogen as free ammonia	1,100

Bacteria in the water caused an organic growth which took form as slime on the sides of the tubes. Slime troubles seriously affected condenser performance, and it was necessary to clean the condenser tubes on an average of once in less than three days.

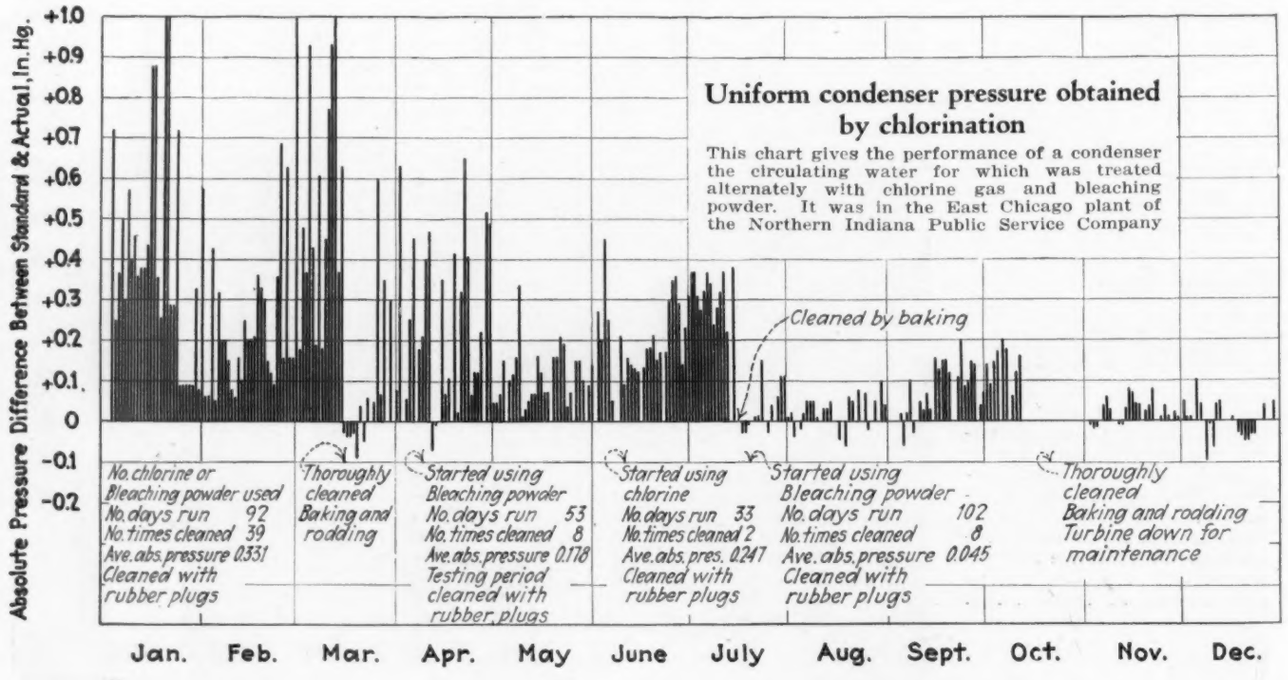
Bleaching powder was first used for treating the water, but later this process was discontinued and chlorine gas was substituted. The chlorine was injected into the circulating water between the circulating pump and the condenser at the rate of 4 lb. every six hours, the supply being taken from a 150-lb. tank at the rate of 1 lb. per minute.

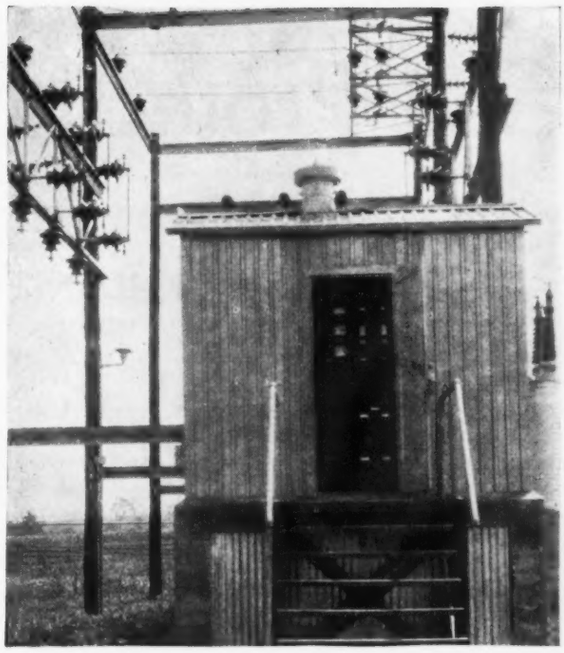
This treatment was continued from June 10 to July 17, 1929, and at the end of that period it was apparent that condenser tubes could be kept free from slime by regular and intermittent treatment of the circulating water. However, an examination of the tubes and water box showed a formation of scale which had caused a gradual decrease in heat transfer. Repeated cleaning with rubber plugs and baking did little good. At this time chlorination of the water with bleaching powder was resumed following a baking and cleaning of the condenser. As in the case of the chlorine gas, the dosage was experimental. After several trials it was decided to mix 20 lb. of bleaching powder with 40 lb. of water and feed the mixture through the suction side of a No. 3 circulating pump at the rate of 5 gal. per minute once every six hours. While this treatment was continued fairly satisfactory condenser performance was attained, and the decrease in heat transfer as the result of scale was not as noticeable as it had been in the chlorination with chlorine gas.

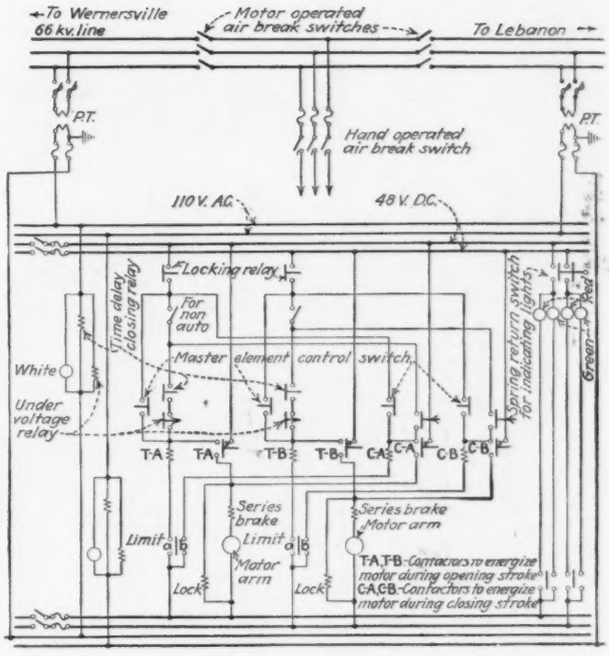
Frequent examination of the tubes and water box showed no appreciable amount of corrosion due to chlorination, the loss in weight being aproximately the same as that which resulted from rubber-plug cleaning.

The advantage of using bleaching powder is the elimination of some of the most serious objections against using chlorine gas—namely, hazard, troubles in the maintenance of equipment, and the elimination of a separate building for chlorinating equipment—according to a report of the Public Service Electric & Gas Company. The chlorinating investigation of that company, as presented in the report, brought out the following:

1. That slime adhesion to condenser tubes can be prevented by chlorination.
2. Chlorination results in the depositing of a hard scale on condenser tubes which must be removed by cleaning by other means than rubber plugs.
3. When circulating water is treated with bleaching powder there is not so much scale deposited on the tubes as with the chlorine-gas treatment.
4. Chlorination does not cause corrosion or excessive loss in weight of condenser tubes.
5. Uniform absolute pressure close to standard performance can be maintained with much less total cost for tube cleaning.







Substation, with dual feed, automatically isolated from defective line by air-break switches

Interlocked Control Assures Service on Dual Feed

By HOWARD L. CRUMLEY

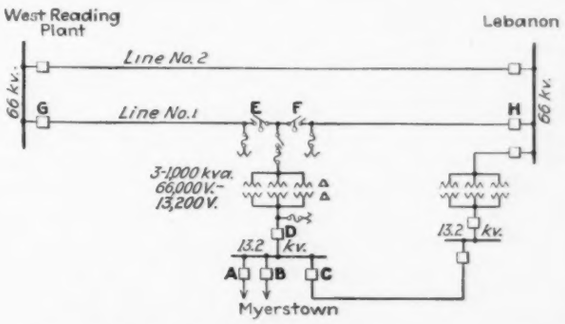
Assistant Superintendent of Operation
Metropolitan Edison Company, Reading, Pa.

The Myerstown substation of the Metropolitan Edison Company is an example of a substation with dual feed, one source of supply from one of two parallel 66-kv. lines and the other from a 13.2-kv. line feeding back from the Lebanon terminus of that 66-kv. line. The employment of automatic control and interlocking in conjunction with motor-operated air-break disconnecting switches has increased the service security for the substation load and co-ordinates the substation functions with the protective installation on the parallel trunk lines.

The 13.2-kv. oil switches are standard motor-operated oil circuit breakers mounted in outdoor steel switch houses. Those breakers marked *A, B, C* are simply automatic reclosing after a definite time interval; power for reclosing them is furnished by a control transformer connected to the 13.2-kv. bus. The oil circuit breaker marked *D* is also automatic reclosing, except that it takes its control power from the 13-kv. side of the 3,000-kva. bank and consequently cannot reclose unless the bank is energized.

The 66-kv. air-break switches marked *E* and *F* are operated by power from a 120 amp.-hour, 48-volt storage battery, trickle-charged. The equipment to operate them is simple, consisting of three plunger type relays for each in addition to that normally necessary.

The substation has been in operation about eight months, the service has been satisfactory and the equipment has functioned as planned. It appears to guard effectively against the usual cases of improper operation. For instance, both 66-kv. potential transformers must be de-energized before either air-break switch will open. This is to prevent a blown potential transformer fuse or a burned-out relay coil from starting the operation and possibly opening one of the switches under load. Two of the relays are used to prevent the operation of both air-break switches at the same time, forcing them to operate one at a time; this reduces the drain on the battery and allows the use of a smaller battery.



Schematic diagram of time-relay control of air-break switches

If transmission line No. 1 develops a fault, it is cleared by the tripping of oil circuit breakers *G, H* and *D*. Two seconds after both of the potential transformers on the line side of *E* and *F* are de-energized, air-break switch *E* begins to open; three seconds later *F* begins to open, provided *E* has completely opened, otherwise it will wait until *E* is completely open.

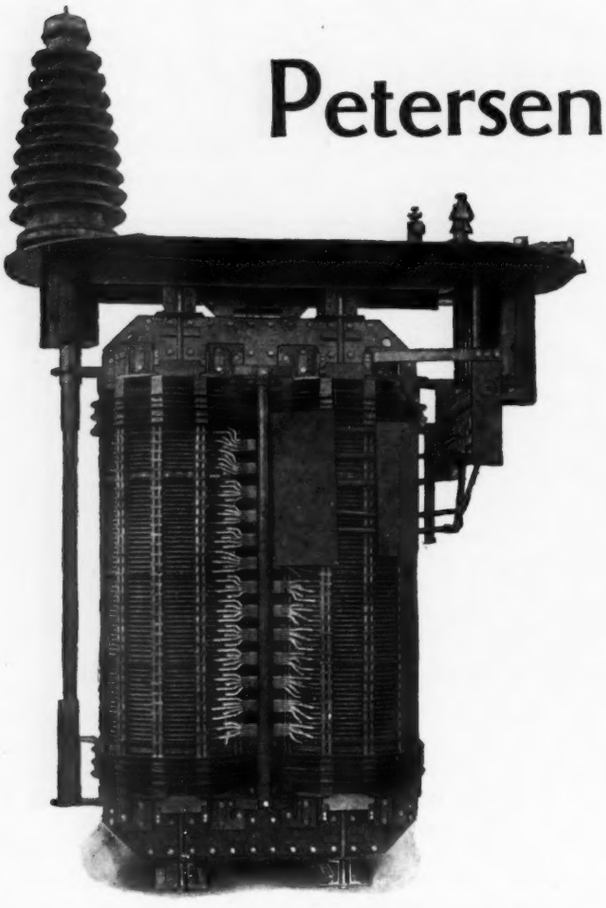
The No. 1 line is now open, the transformer bank is dead and the local load is being carried by the 13.2-kv. line from Lebanon.

If either end of the No. 1 line is again energized, the air-break switch to that end will close within several seconds after the line is energized. The closing of this air-break switch will energize the transformer bank and fifteen seconds later the 13.2-kv. bank oil switch will close and provide another source of feed to the bus. If, after this, the other end of No. 1 line is energized, the other air-break switch will close and the transmission line will be tied through for normal operation.

Petersen Coil Protection

By F. RUDENBERG

Berlin, Germany



Internal arrangement of 6,300-kva., 110-kv. arcing-ground suppressor

FAULTS to ground are the most frequent causes of disturbances in high-tension transmission networks. Protection against grounds is thus of fundamental importance for warranting a dependable supply of current. In unprotected networks a ground results in disturbances at the point of fault and in other sections of the system, not only during the climax of the fault to ground but frequently also at a much later time. The charging current passing to ground at the fault is usually accompanied by a more or less vicious power arc, and this may cause the destruction of insulators and the fusing of conductors. If the arcing ground reaches the adjacent phases, the inevitable result is surging stresses on the generators and transformers connected to the short circuit and an interruption in the supply on the affected sections of the network. Moreover, the voltage at the point where the charging current enters the ground may possibly be of imminent danger to human beings and animals. Furthermore, the ground can produce deleterious effects on telephone lines in the vicinity.

The arcing ground may be an originator of high overvoltages, resulting from the arcs, recurring every half cycle. These surges weaken the insulation of the entire network and frequently initiate destruction of transformers and line insulators, ultimately causing double-line grounds.

The protective scheme usually used in the United States to prevent these phenomena is to ground the neutral solidly or through a low resistance. This limits the duration of the action of the harmful current and voltage forces emanating from a fault to ground to a few seconds or less. The interruption of the supply on the faulty section as postulated by this method renders imperative the adoption of double-circuit lines and correspondingly higher costs, even for networks of medium power capacity.

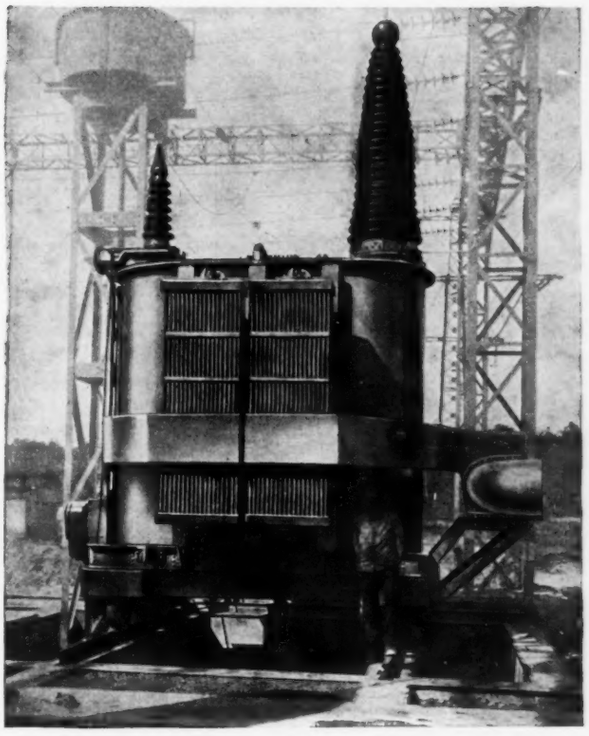
In very large power systems the short-circuit surges inseparable from the grounded-neutral arrangement may lead to the falling out of step of synchronous generators and motors. Thus, in spite of a supply using double-circuit lines, a dependable service for the consumer is not fully guaranteed.

Experiences with neutral-point grounding, which have become especially troublesome in recent years, have directed America's attention to a method of combating the problem of faults to ground in a way that has gained an increasingly firmer footing in central Europe during the last decade. This is the method of ground protection by the use of the Petersen arcing-ground suppressor. It differs from the neutral-point grounding system in that it eliminates the short-circuit surges which attack the entire network and necessitate the disconnection of the faulty line.

The fundamental principle of the Petersen coil is to render the point of fault currentless by superimposing an inductive current on the clearing current flowing to ground at the fault. The production of the inductive current which serves to counteract the capacitive current is extremely simple. Thus, if a reactance coil is connected between the neutral point of the system and ground, it is momentarily at phase voltage when a ground occurs. If properly dimensioned, it is traversed by an inductive current which is equal but opposed to that of the capacitive current flowing to ground at the fault. The point of fault becomes practically currentless because of this superposition. An arcing ground is therefore suppressed within a period of a few current cycles.

All the harmful after effects linked with arcing grounds are prevented. More especially, there is an absence of the short-circuit surges and voltages accompanying the neutral-point grounding method; the generators are free from the effects of grounds. Also, the Petersen protection permits the line to be maintained in service in the presence of a sustained ground. It therefore prevents extempore disconnection of the sec-

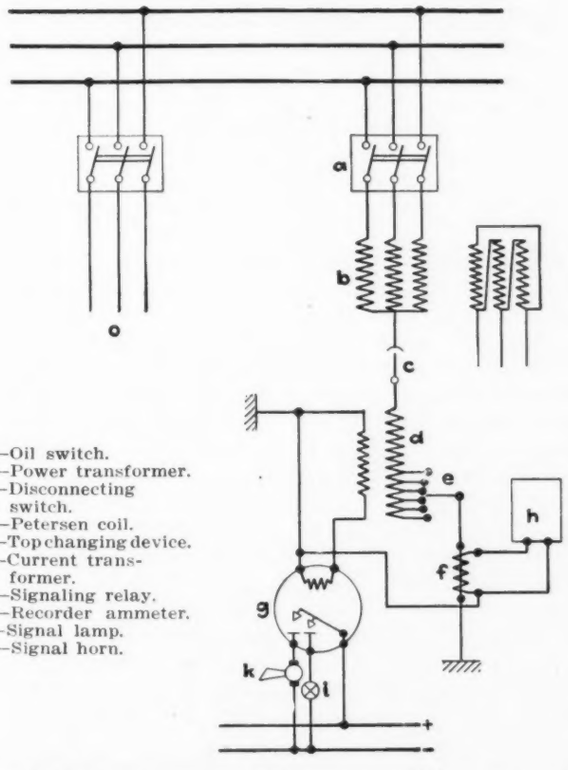
European experience proves ground protection can be had. Reduced cost, less complexity, fewer interruptions claimed. Theory and experiences



12,000-kva. Petersen coil for use on 220-kv. circuits

tion burdened with the ground and permits the exchange of insulators, if necessity demands, many hours after the occurence of the ground or when the line management deems this to be opportune. The arcing ground is extinguished within a few cycles; it is impossible for it to develop into a short-circuit arc that attacks neighboring phases. It is equally impossible for it to fuse the line at the point of fault or to cause destruction of insulators in its vicinity. Overvoltages due to grounds are prevented, and hence the high-tension network is even free from the indirect consequences of grounds.

The experience with the Petersen coil as accumulated today is based on observations in approximately 400 high-tension networks. The A.E.G., Berlin, which introduced the Petersen method into practice, has alone protected transmission systems with an aggregate length of more than 160,000 km. This experience has been acquired in high-tension networks with working voltages ranging between about 2,200 volts and 220,000 volts and capacitive earth currents of a few amperes up to more than 2,000. It is employed in overhead and underground cable networks of varying size and configuration (up to an individual length of overhead line of about 4,000 km.). The suitability of this protection for radial systems and meshed networks, for single- and double-circuit lines, has been proved, irrespective of whether the lines are electrically interconnected or are separated. This system can also be adapted to satisfy the special conditions of two lines at different working voltages mounted on the same towers.

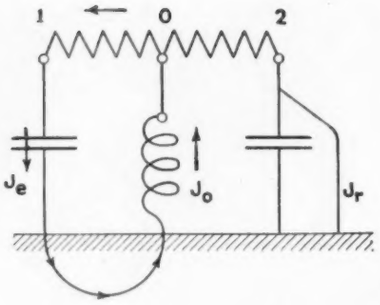


a—Oil switch.
b—Power transformer.
c—Disconnecting switch.
d—Petersen coil.
e—Top changing device.
f—Current transformer.
g—Signaling relay.
h—Recorder ammeter.
i—Signal lamp.
k—Signal horn.

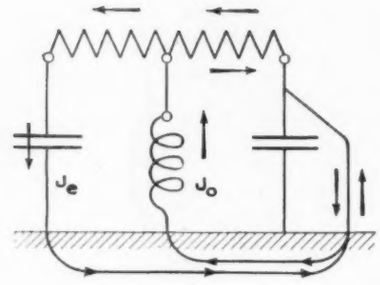
Typical arrangement of Petersen coil for protection against arcing grounds

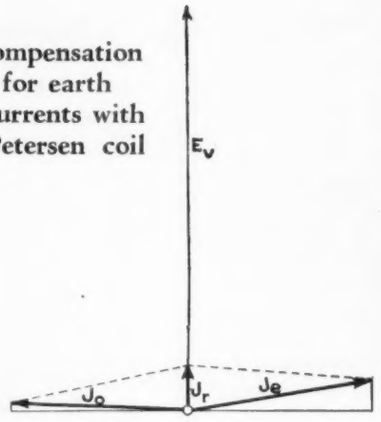
In general there are no fundamental or practical intricacies associated with the installation of the system in existing networks except the condition that those sections of the transformer windings lying adjacent to the star point must be at least insulated for the phase voltage of the system. Moreover, this condition is generally fulfilled in networks up to above 66 kv., and departure from this practice must be regarded with skepticism, especially in large-power systems, if an adequate protection against lightning is to be obtained.

The capacitive earth current, I_e, embraces a small watt component originated by the copper losses in the line, in the ground, etc. The reactance coil current, I_o, also possesses a watt component caused by its iron and copper losses. The currents, I_o and I_e, are combined at the point of fault to ground. The resultant watt component residual current is in phase with the voltage E_v and amounts to 2 to 12 per cent of the capacitive earth current I_e, the lower values applying for high-tension overhead lines during dry weather or for cable networks. This decided reduction of the current to ground at the fault obviously minimizes, both in overhead and underground networks, the danger of the ground devel-

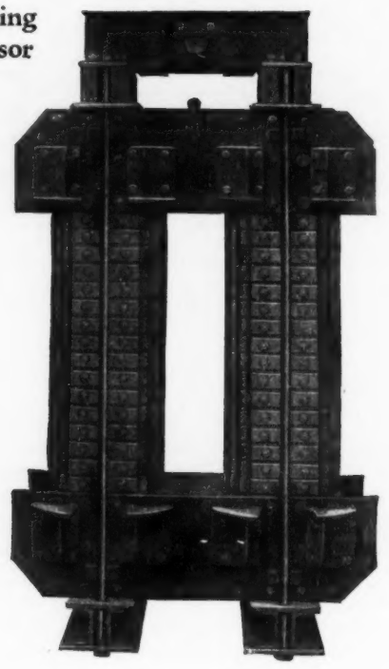


Compensation for earth currents with Petersen coil





Core of an arcing ground suppressor



oping into a short circuit. Consequently, the arcing ground is extinguished within a very small fraction of a second, even in systems with a current to ground of hundreds—in fact, several thousands—of amperes. If the degree of reduction of the earth current to the residual current is not sufficient in extensive high-voltage cable networks to prevent a sustained ground from being converted into a short circuit, there is still the great advantage that selective relays can disconnect the faulty section quickly, i.e., before a short circuit occurs. But as such networks invariably operate with parallel cables, disconnection of one of them has no influence upon the supply. This prevention of short circuits is particularly important in city networks.

The incorporation of a Petersen suppressor in cable and overhead systems invariably effects immediate quenching of the arcing ground even where the residual watt current assumes a value of 50 amp. or more. The explanation for this can only be briefly outlined in this article. It is possible to discharge a condenser (network capacity) without re-arcing by connecting an inductance in parallel with it. The potential difference at the switching points (i.e., the voltage at the point of ground for forming the arc) is a minimum when the frequency of the discharge oscillations coincides with the working frequency. The inductivity of the Petersen coil is actually so attuned that this condition obtains in the electrical circuit formed by the coil and the network capacitance. Thus the re-arcing occurring in an unprotected network and the overvoltages liberated by them cannot develop in networks with the Petersen protection.

Duplicate lines reduced

The reduction of the capacitive earth current to 10 to 20 per cent of its natural value and the extinguishing of the arcing ground within a few cycles reduce the number of undesirable line disconnections as compared with unprotected networks and substantially limit transformer and line troubles.

The following data on observations made in two European networks, operating at working voltages of 22 kv. and 110 kv. respectively, are examples of the large number of reports available:

A.—22-kv., three-phase system, 50 cycles; length of network, approximately 500 km.; capacitive earth current, about 35 amp.

Line Interruptions Before and After Installing Petersen Arcing-Ground Coil

Month	1923	1924
September	63	7
October	52	7
November	25	6
December	43	2
Total interruptions	183	22

B.—110-kv., three-phase system, 50 cycles; length of network, about 350 km., double-circuit line. Year of observation, 1928.

1. Service with insulated neutral but without Petersen coil: Of eight faults to ground, only one did not cause an interruption; i.e., disturbance ratio, about 87 per cent.
2. Service with Petersen coil: Of nine faults to ground, only one caused interruption; i.e., disturbance ratio, about 11 per cent.

One of the great merits of the Petersen protection is that it acts automatically in the event of faults and does not require the aid of relays or auxiliary spark gaps. Apart from extensive cable networks in which selective ground relays may be desirable, relays are used with this protection only for signaling purposes; i.e., to ascertain which of the different high-tension sections has developed a fault to ground. Another point of major importance is the fact that the cost of the Petersen protection barely amounts to 1 per cent of the initial costs of the actual transmission line protected. (This does not apply to very high-voltage overhead lines and to cable systems.)

In networks furnished with the Petersen coil the arcing ground is suppressed with certainty, even when there is a wide difference between the suppressor's current and the current to ground. In medium-voltage transmission networks a coil adjusted to 100 per cent of the total length of the line will still fulfill its duty without requiring resetting when the length of the system fluctuates between 80 per cent and 125 per cent. However, in networks carrying very large earth cur-

rents it is generally desirable to utilize fully the advantage accruing from minimizing the absolute value of the earth current. For this purpose the Petersen coil is provided with a number of taps, or else certain sections of the network are equipped with separate Petersen coils. Naturally, the tap-changing switch of the coil can be devised for remote control and for tap-changing under load; i.e., in the presence of a ground. Hitherto, however, there has been little demand for the latter arrangement. The adjustment of the suppressor current to the capacitive earth current, whose value fluctuates according to the length of the network, therefore presents no difficulties.

Petersen suppressors intended for overhead-line service are advantageously rated for continuous duty, or at least for two-hour duty. The frequently established advantage of carrying on service operation during a sustained ground until such time as it may be expedient to take remedial measures should not be sacrificed for the sake of a slight saving in initial cost.

Insulation and construction details

The general construction of the Petersen coil is similar to that of a single-phase core-type transformer. It is of fundamental importance to build them to be iron-cored reactances. Their legs are subdivided by a large number of air gaps, and the insulation of the winding is best designed for the working voltage of the network to be protected.

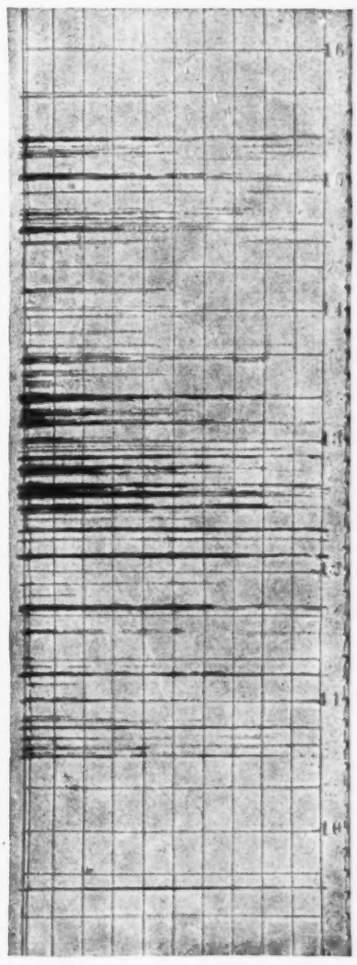
It was formerly thought that a transmission network with Petersen protection had to be more substantially insulated than one with neutral point grounded and that, therefore, the use of the coil involved a more costly network. Measurements undertaken during recent years on high-tension lines reveal that the overvoltages occurring during thunderstorms are much higher than those usually arising from all other causes. The magnitude of the overvoltages due to lightning is, however, entirely independent of whether a network is equipped with the Petersen coil or employs a grounded neutral point. Accordingly, to achieve the same degree of reliability, networks with solidly grounded neutral point must not be insulated for lower values than those used with Petersen coils.

The introduction of the Petersen coil does not tend to form double-line grounds as formerly asserted. In unprotected supply systems such grounds are mainly the outcome of the entire insulation being weakened by overvoltages caused by recurrences of the arc. These are, however, eliminated by installing the Petersen coil, and thus there is no inclination to the formation of double-line grounds. The greater stress on the insulation during a sustained ground owing to the ungrounded conductor being subjected to the line instead of the phase voltage is of no consequence when offset against the stresses due to atmospheric disturbances.

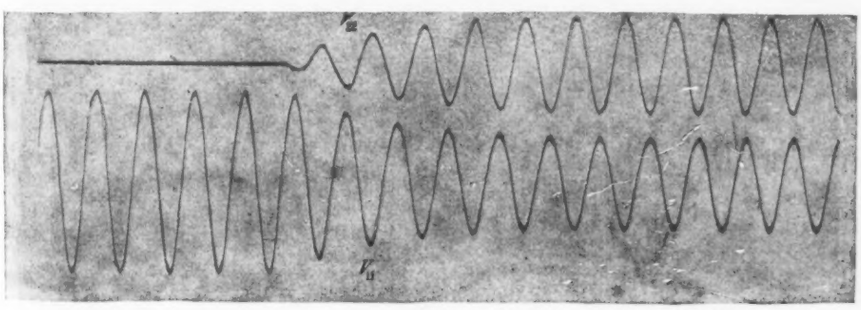
For satisfactory operation of the Petersen coil it is desirable that the voltage curve of the network shall be fairly sinusoidal. Twenty years ago this condition may not have been entirely fulfilled in a number of networks. Today, however, especial importance is attached to this factor in all important networks for other service reasons. Actually, among the hundreds of networks protected with the coil there are only a few where an improvement in the extinguishing action has been found desirable. These could be satisfied by providing a "filter" connection in the circuit of the suppressor. This necessity has never arisen in very high-voltage transmission networks.

The Petersen coil and the network capacity are so attuned to each other that they form a resonance circuit when operating at the working frequency. When the line is free from grounds, currents and voltages can develop in this circuit only when, for some reason, there is a potential between the neutral point and the ground. Such voltage occurs if the line capacities of the three phases to ground are dissymmetrical. Theoretically, a comparatively small neutral-point voltage could then produce an unfavorably high working voltage at the coil or at the network capacity; i.e., between conductors and ground. With a well-designed coil, however, the magnetic flux traverses a closed iron core. Consequently, resonance voltages are impossible in the circuit embracing the inductivity of the coil and the network capacity, for an excess in the normal voltage on the suppressor would lead to an alteration

Chart record of Petersen coil performance



Oscillograph of arcing-ground suppression



of its inductivity and hence to untuning of the resonance circuit.

A marked dissymmetry of the earth capacitances of the individual phases is, moreover, not tolerated in modern high-tension networks because of the effects on neighboring telephone lines. They can be almost entirely eliminated, without very great expense, by effecting transposition of the lines.

Accordingly, in all modern high-tension systems the neutral-point voltage during service is generally exceedingly small in comparison with the network voltage.

The objections leveled against the system of compensation of the capacitive earth current are without practical foundation and are unimportant. The extensive and highly satisfactory experience with the Petersen protection in all kinds of networks, especially in central Europe, during the last decade has resulted in its now being regarded as the fundamental protection against grounds, the most frequent and dangerous disturbance in high-tension networks.

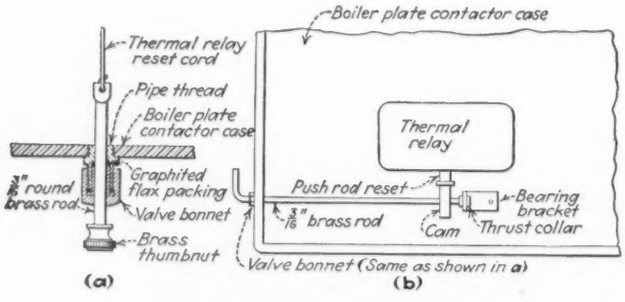
▼

Simple Devices Permit Outside Relay Resetting

By J. S. BROWN
Stone & Webster Engineering Corporation

On a recent industrial job a large number of boiler-plate-cased, gasketed, marine-type magnetic contactors were installed to assure reliability of operation in an area in which the air is filled with sodium nitrate in dust form. The contactors were of standard manufacture, but it was necessary to unbolt the gasketed cover to reset the thermal overload relays. This was a very undesirable feature, and a serious delay would have been involved in correcting it at the factory.

The problem was solved with the simple, inexpensive outside thermal relay-resetting device shown in the accompanying illustration. As no manufacturer could furnish a packing gland of the valve-bonnet type for the $\frac{3}{16}$-in. stem used in these devices, they were made by a specialty machine shop. The packing used was petroleum-saturated flax twine supplied originally for underground cable splicing work.



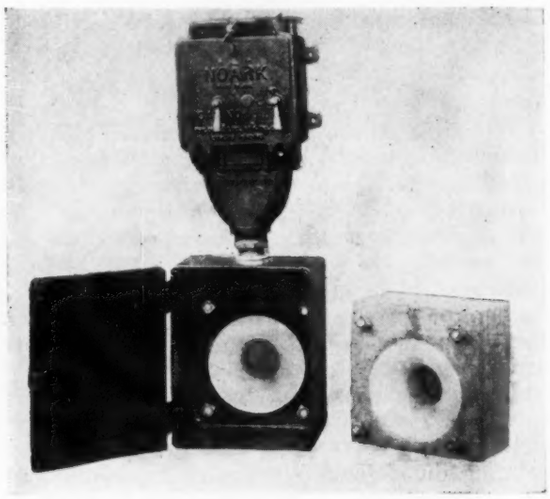
Outside reset device solves marine contactor problem

(a) Method used for resetting the pull-cord type of thermal relay supplied with the small contactors. This arrangement can also be used as a push-rod reset. (b) Method of resetting push-rod reset type of thermal relay furnished with large contactors (300 amp. and over).

▼

One-Third Saving in Service Entrance

A simple and economical type of residential service entrance has been developed by the Fall River (Mass.) Electric Light Company, based on the use of the concrete bell construction devised by William Beauregard of that organization for underground duct applications. The equipment consists of a porcelain bell flared out at one end to provide a smooth passage for wires or cables. The bell is cast in a rectangular concrete block furnished with four inverted bolts. The cement block inclosing the bell is inserted in the wall of the building at the point of the service entrance, the larger end of the bell being flush with the inner surface of the wall. An iron box with necessary conduit knockouts and a hinged cover is fastened on the wall with a hole in the back of the box fitting the entrance bell. Four slotted holes in the back of the box correspond to the insert bolts in the cement block. This facilitates alignment.



Assembled entrance bell and service box

In making an installation, the underground cable is passed through the bell and the house wires are taken through the house conduit nipple through the hood connected to the cut-out or safety switch. The neutral wire may be grounded in the box through one of the bolts. The sizes of service boxes, blocks and bells vary with the current, voltage and size of entrance conduit requirements. The block is precast by means of a metal collapsible form, resulting in uniform size of block.

A comparison of labor and material costs between the ordinary service terminal installation and the bell-block method reveals a saving, according to the company, of at least 33 per cent for the bell block.

Circuit-Breaker Duty Affected by Speed

By C. L. DENAULT

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

When circuit is opened by breaker the voltage recovers.

The circuit characteristics determine the rate of voltage recovery.

Delayed recovery promotes deionization, less arc length, time and energy.

THE interrupting capacity of high-power a.c. switches is a rather variable quantity, as shown by many comparative tests made in the laboratory and in the field. That other factors besides current and voltage are present to modify the circuit-interrupting ability of these switching devices is well known. These factors, which are referred to in a general way as the characteristics of the circuit, include: (1) The power factor of the short-circuit current, and (2) the "circuit speed" as it influences the rate of rise of re-established voltage following a current zero.

The conductivity of an arc core is due to the high density of ions present in this region, and in order to effect the change from an arc to a dielectric during the extinction process, the ion density must become greatly reduced. According to present theory,[1,2] there are two general ways in which this reduction can take place, i.e., by recombination of the ions and electrons to form neutral molecules and by diffusion of the ions and electrons from the region of the arc core into the electrodes, or into the adjacent bodies of relatively un-ionized gas. Both of these deionizing processes require time.

On the other hand, at the instant of arc extinction, which usually takes place within a very few microseconds of a normal current zero,[3,4] we find that the voltage across the arc space rises rapidly, following some transient curve which is determined by the conditions of the circuit. This rapidly rising voltage, which is impressed across the arc space, tends to reignite the arc; whether it does or not depends entirely upon how rapidly the ion density in the arc core region is being reduced as compared with the rate at which the voltage across this region is increasing.

From the foregoing, we can see that there are two points of attack if we wish to aid in the circuit interruption process. We can aid in the deionization of the arc by proper design of the circuit-interrupting device itself. Examples of switches of this sort are the "straight" Deion and the combined grid and oil Deion circuit breakers, each of which illustrates a distinctly different principle of operation.

The other method at our disposal is to modify the rate of rise of voltage tending to reignite the arc. In the laboratory this can be accomplished by a manipulation of the characteristics of the circuit itself, and is brought about by the use of resistance or capacity shunts across various portions of the circuit, or by adjusting the circuit power factor. In practical systems it is not ordinarily possible to "juggle the circuit," yet it is possible to have a considerable variation in the rate of rise of voltage, which effect is due to the nature, magnitude and distribution of the load. It is a well-known fact that any given distribution system may from time to time exhibit widely different effects with respect to the circuit-interrupting duty imposed on a circuit breaker, purely as a result of load conditions, apart from the r.m.s. voltage and current involved.

The effect of power factor may be considered in

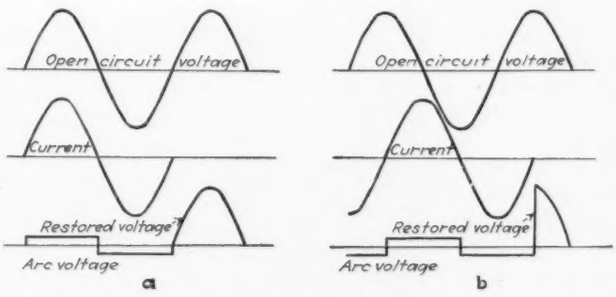


Fig. 1—Rate of voltage recovery determined by phase relations

(a) Sinusoidal recovery when open-circuit voltage is in phase with current interrupted.
(b) Rapid recovery when interrupted current lags voltage by 90 deg.

[1] *Slepian, Transactions A.I.E.E. 47, page 1,398, 1928.*

[2] *Slepian, Transactions A.I.E.E. 49, page 21, 1930.*

[3] *Todd, Physical Review.*

[4] *Krausnick, thesis, University of Michigan, 1930.*

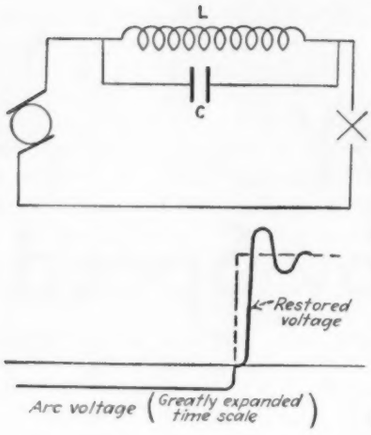


Fig. 2—Oscillatory circuit conditions create lag during which deionization occurs

Fig. 3—Inductance delays voltage recovery

another way. In Fig. 1a we have a graph which represents the current and voltage relations existing in a "perfect" non-inductive circuit. Here, where the current and the open circuit voltage are in phase, the re-established voltage following the last current zero rises comparatively slowly, at the rate of $2\pi f$ volts per second. In this case, it can be seen that we are not greatly concerned with the possibilitites of manipulating the circuit constants as an aid to the extinction of the arc. If, however, current lags the voltage by nearly 90 deg., as shown in Fig. 1b, the re-established voltage will rise quickly to almost the maximum value, along a transient curve which is determined by the circuit constants. That the large part of the short-circuit currents which are to be cleared by circuit breakers approach this second condition is unfortunate, but true, and this fact forces us to consider seriously the transient rise of voltage following the last current zero, or, as has been expressed earlier, the "circuit speed" of the distribution system at the point of the short circuit.

As shown by Slepian,[1,2] the transient characteristics of the circuit, in so far as they affect the rate of rise of voltage across the arc space, may be determined with fair accuracy from the constants of the circuit. In general, the two major characteristics of interest are: (1) The free oscillation period of the circuit external to the arc, and (2) the relaxation time of the circuit.

The time available for the transition of the arc space from an arc to a dielectric is,

[1,2] *See footnote on page 913.*

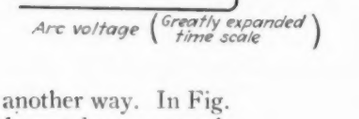
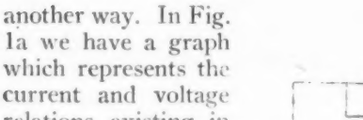
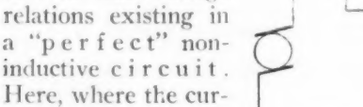
Circuits A and B are equivalent for steady state conditions using 60 cycles. The time constants however are much different. This also applies to circuits C and D. The effect of a power load was determined using circuit E	Test Number 1	Arc Length-Inches (Average) 2	Half Cycles Arcing (Average) 3	Short Circuit Current (Average) 4	Re-established Voltage (Average) 5	Arc Energy Kw. Sec. 6	Calculated Phase Angle 7
A	200 201	5	10-11	352	6,800	12 16+	60°
B	202 203 204 205	1.64	3	364	6,900	1.2 1.16 1.13 1.02	60°
C 	211 212	3.61	6.9	1,950	2,100	13.3 25.5	60°
D 	206 207 208	1.81	3.8	2,130	2,240	7.5 9.2 4.5	60°
E 	209 210	0.90	1.9	1,900	2,020	1.5 3.2	60°

Fig. 4—Wide range of arcing time and arc energy for various circuit constants

according to Slepian, as great as or greater than a quarter period of the free oscillation of the circuit external to the arc. This is shown in Fig. 4, where a circuit is indicated in which the inductance L and the capacitance C is shown lumped for simplicity. The period of free oscillation of the circuit external to the arc is $T = 2\pi\sqrt{LC}$, which oscillation will be superimposed on the rapidly rising restored voltage of Fig. 1b to give the modified restored voltage of Fig. 2, which allows, as can be seen, a finite time for the transition.

The effect of the relaxation time of the circuit can similarly be indicated for a simple circuit. Here again (Fig. 3) a circuit is indicated in which a resistance R shunts the lumped reactance L. The voltage in such a circuit, following the final current zero, will rise to the

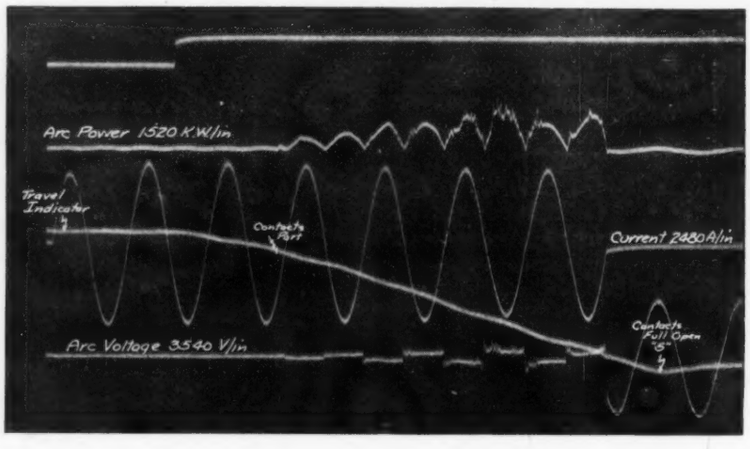


Fig. 5—Oscillogram for test 212 with circuit conditions C of Fig. 4

final open circuit voltage following an exponential curve as determined by the expression

$$E = E_0 \ (1 - \epsilon^{-\frac{R}{L} t})$$

In this circuit it is the relaxation time, the ratio $\frac{L}{R}$, which affords a measure of the time available for the transition from arc to dielectric.

Experiments substantiate theory

A series of experiments illustrates very nicely the effect of "circuit speed" on a circuit-interrupting device operating on a practical laboratory circuit.

The circuit-interrupting device in these tests was a single-break, experimental oil circuit breaker. The source of power was either of two banks of transformers, one a 2,000-kva., six-unit bank, capable of being connected in a variety of ways; the other, a two-unit bank consisting of one 333-kva. and one 500-kva. transformer.

As indicated in the circuit diagrams of Fig. 4, the short-circuit current is determined by the reactance (X_t) and the resistance (R_t) of the transformer bank and also by an external air core reactor (x) and a water rheostat (r). In tests made on the circuits described in circuit diagrams A and B the reactance and resistance were so adjusted that in both cases the short-circuit currents, re-established voltages and power factors were very nearly the same. The "circuit speeds," however, were widely different, circuit A being theoretically the more difficult to open.

The test results are self-explanatory and show very clearly that the arc length for interruption of the "faster" circuit was about three times that required for the "slower" circuit.

Circuits C and D are also combinations of resistance and reactance and are comparable circuits from a steady-state viewpoint. Here, too, the "faster" circuit requires a longer time for operation, the ratio in this case being about two to one.

In order to illustrate the effect of a "load" on the "circuit speed," a 1,200-kw. resistance load was placed across the power transformers of circuit C, as indicated in set-up E. In this test the effect of the load was to reduce the necessary length of arc for clearing of the circuit to one-fourth the length required by the unloaded circuit.

As mentioned earlier, comparisons made in the laboratory and in the field usually give quite different results in terms of the maximum kva. that can be interrupted by the breaker under test. For the most part, these differences in average performance may be attributed to the characteristics of the circuit as reviewed in this paper.

▼ ▼ ▼

Variable Voltage Control for Anti-Friction Bearing Machines

By K. L. HOWE

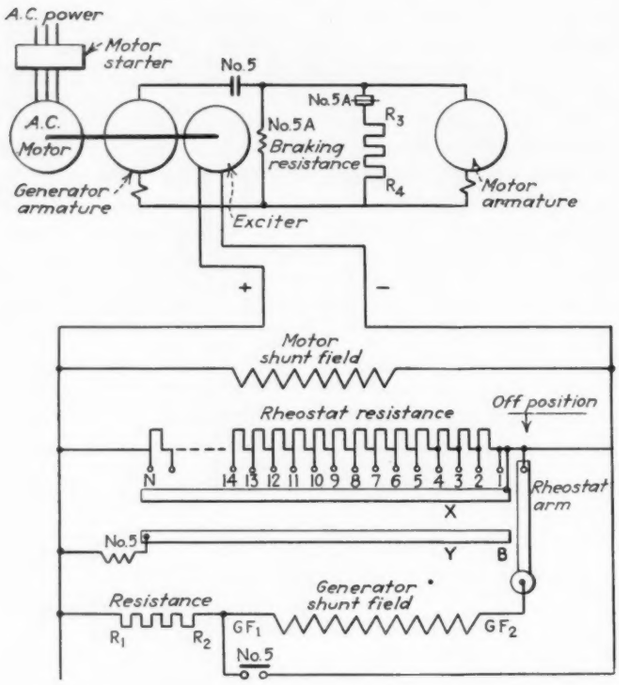
Engineering Department, Westinghouse Electric & Manufacturing Company, Seattle, Wash.

VARIABLE-VOLTAGE control, otherwise known as the Ward-Leonard system, is a basic principle for obtaining definite speeds of a direct-current motor over a wide range. Until recently limits of speed control, as determined by residual voltage and maximum voltage of the generator, have been entirely adequate. However, with the widespread application of anti-friction bearings to all classes of machines it has been found that residual voltage on the generator gives motor speeds faster than the desired minimum speed. Simple modifications to the customary form of variable-voltage control permit operating the generator from an absolute zero voltage to the maximum generator voltage, thus making it possible to fix the minimum motor speed definitely at zero.

The familiar arrangement of apparatus making up a unit of variable-voltage control consists of a direct-current motor driving a load whose speed must be varied from zero to a maximum by small increments of speed change, a generator of corresponding rating which will deliver energy to the motor armature only (the generator is usually driven by an alternating-current motor) and a source of constant direct-current potential. If a general service direct-current bus is not available an exciter may be added to make up a three-unit motor-generator set. With an exciter the system is entirely self-contained and requires only a source of alternating-current power.

By referring to the accompanying schematic diagram, it will be seen that the armature circuits of the direct-current motor and generator are completed by a single contactor, No. 5. No. 5 contactor coil is energized on the first point of control as the rheostat arm is moved to position *B*. Contact bars *X* and *Y* are connected through the rheostat arm to complete the circuit to No. 5 coil from the exciter which serves as a control bus. Moving the rheostat arm successively to buttons 2, 3, 4, 5, etc., increases the voltage applied to the generator shunt field in proportion to the potentiometer voltage of the rheostat resistance, since the generator shunt field is being connected in parallel with an increasing number of buttons of the rheostat. At position *N* the generator field is subjected to full exciter voltage producing maximum generator voltage. Rheostats used for this system of control usually have 75 to 125 buttons, thus providing increase in generator voltage from zero to maximum by increments of very small value, with simultaneous proportional increase in motor speed to a maximum.

If the rheostat arm is now returned to position *B* excitation from the exciter bus will be zero, since the brush of the rheostat arm rests on a contact button connected directly to the negative exciter bus and the opposite end of the field is connected to the same bus.



Modified variable-voltage control to eliminate residual generator field and give zero motor speed

Even with zero excitation, residual magnetism will develop residual voltage.

Assuming that interlock No. 5, shown between *GF*-1 and the negative bus, and resistance *R*-1, *R*-2, have not been provided, but that *GF*-1 is connected directly to the negative bus, armature contact No. 5 is simply opened and No. 5*A* closed by moving the rheostat arm to the off position. The next time the direct-current motor is started by moving the rheostat arm to position *B* the motor will be subjected to generator residual voltage, which may be 12 or 15 volts in the case of a 250-volt generator. Many machines which are now equipped with anti-friction bearings will start altogether too rapidly under these conditions when lightly loaded. Paper winders and similar equipment used in the paper industry may be started with a very light spool on the winder rolls, and unless the start is very gradual the paper will be broken. For this reason it has been found necessary to eliminate all residual voltage by the use of interlock No. 5 and resistors *R*-1, *R*-2.

Eliminating residual field

With this arrangement the rheostat arm in moving to the off position opens interlock No. 5 at the same time that contact No. 5, armature circuit, is opened, thus disconnecting *GF*-1 from the exciter bus. A connection remains between *GF*-1 and the positive bus through resistance *R*-1, *R*-2. Since *GF*-2 is connected to the negative bus through the rheostat arm, there is a small amount of reverse current flowing through the generator field. The value of the reverse current is determined by the resistance *R*-1, *R*-2, an average approximation being 75 times the field resistance. Proper adjustment of *R*-1, *R*-2 will eliminate residual voltage. Now, closing the armature circuit through No. 5 contact produces no effect, since the generator voltage is zero.

An interesting point in connection with this simplified armature circuit is the effect of the motor series field in producing a tendency toward uniform dynamic braking. Contact No. 5*A* closes as No. 5 opens and establishes a circuit around the motor armature through braking resistance *R*-3, *R*-4. The motor series field is differential with respect to the shunt field during the braking period and tends to maintain the original value of braking current determined by the adjustment of *R*-3, *R*-4. Commutation difficulties are greatly relieved by use of the motor series field.

Proceeding from position *B*, the first point of control, the generator field may be subjected to small values of potentiometer voltage by selecting low values of resistance per step from points 1 to 6. The result is that a very gradual starting of the motor is obtained. In the case of a paper winder with the motor direct connected to an 18-in. diameter roll, the initial speed of the surface of the roll can be made less than 9 ft. per minute.

The performance characteristics given above apply to any easy-starting or anti-friction-bearing machine using variable-voltage control, irrespective of the size of the motor. The problem of easy starting applies to numerous industries where equipment is started under light-load conditions and where the driving effort is being reduced by improved quality of design on the part of the machinery manufacturer. The modifications shown in the attached sketch can easily be incorporated to make an ideal variable-voltage control for any requirement.

Natural vs. Artificial Sources as Ultraviolet Radiators

Intensities* of illumination necessary to deliver equal total amounts of erythema-producing radiation throughout four different periods of exposure.—M. S. LUCKIESH.

	Foot-Candles			
	One Hours	Two Hours	Four Hours	Eight Hours
Sunlight plus skylight				
1. Midday midsummer	3,000	1,500	750	375
2. Midday equinox	7,000	3,500	1,750	875
High-pressure mercury arcs				
3. Quartz mercury arc (new)	6	3	2	1
4. Quartz mercury arc (2,000 hours)	12	6	3	2
Corex D filter, 0.8 mm	21	11	6	3
With 888 filter, 0.6 mm	23	12	6	3
With 690 filter, 0.9 mm	55	28	14	7
Low-pressure mercury arcs				
5. Tube of 888 glass	96	48	24	12
With porcelain reflector	185	93	46	23
6. Tube of 690 glass	150	75	38	19
With porcelain reflector	293	146	73	37
Sunlight (Type S-1) lamps, oxidized aluminum reflector				
7. Average Corex D bulbs	67	33	17	9
8. Average 690 bulbs	106	53	27	13
Tungsten-filament lamps, 310 deg. K				
9. Bulb of 888 glass	2,400	1,200	600	300
10. Corex D bulb	1,680	840	420	210

*Presented before Richmond, Va., convention of I.E.S.

Turbine Service Availability Increases During 1929

Troubles incident to turbine blading dropped from a total outage of 440 hours per unit in 1928 to 294 hours in 1929 and the time the turbines were available for service in 1929 showed a slight increase over that in 1928, according to an N.E.L.A. prime mover committee report which included operating data for 276 turbines of 20,000 kw. and larger. Troubles due to turbine blading, however, are still the greatest single cause of turbine outage.

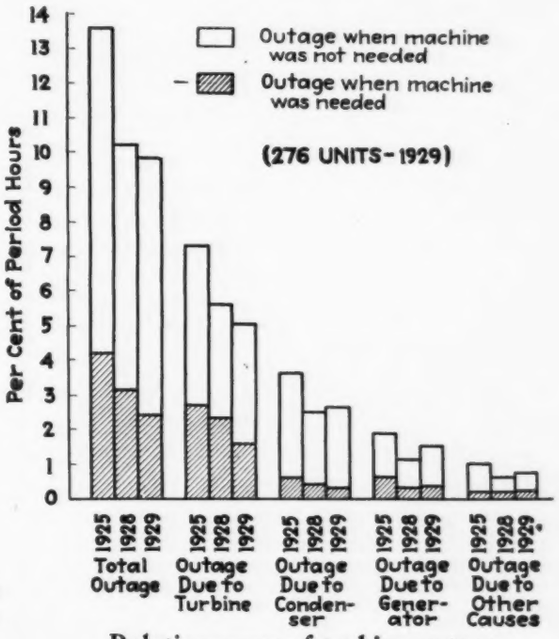
Of 292 units reporting, 101 have a service-hour factor of 80 per cent or greater with an average unit outage factor of 7.2 per cent, as against an outage factor of 6.6 per cent for 1928. A service-hour factor greater than 50 per cent with an average unit outage factor of 8.9 per cent is reported for 237 units of the 292. For the same service factor range in 1928 for 163 units the average unit outage factor was 9.9 per cent, showing a decrease of 1 per cent for 1929. As was the case in 1928, the 40 to 50 per cent service factor group shows the highest unit outage factor The average total outage factor for all machines in 1929 was 9.82 per cent, while that for those with a service factor of 40 to 50 per cent

Inspection and Cleaning Biggest Outage Factors*

Condenser	Outage Hours	Per Cent of Total
Leakage	4,038	6.44
Cleaning	47,528	75.86
Tubes	3,859	6.15
Shell	411	0.66
Circulating pumps	2,514	4.01
Condensate pumps	751	1.20
Air pumps	754	1.20
Miscellaneous	2,800	4.47
Total for repair and maintenance	62,655	100.00
Generator		
Vibration	1,066	3.03
Oil leakage	681	1.94
Armature core	1,785	5.07
Armature windings	2,133	6.06
Field windings	5,607	15.93
Exciter	1,070	3.04
Annual inspection and cleaning	12,817	36.42
Miscellaneous	10,031	28.51
Total for repair and maintenance	35,190	100.00

* 276 units, 1929.

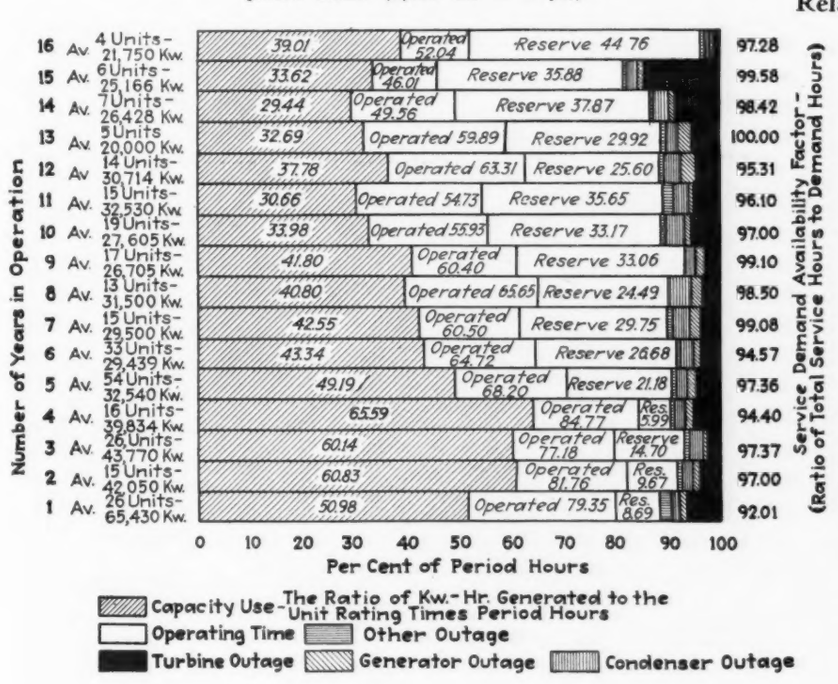
Turbine	Outage Hours	Per Cent of Total
Steam casing	1,422	1.18
Governors	1,601	1.33
Control gear	4,133	3.44
Shaft packing	2,196	1.83
Nozzles and diaphragms	1,787	1.49
Shaft	353	0.29
Wheels or spindle	7,155	5.95
Buckets or blades	14,671	12.20
Vibration	1,780	1.48
Bearings	2,917	2.42
Lubrication system	2,739	2.28
Cleaning oil system	3,817	3.17
Annual inspection and adjustment	65,825	54.73
Miscellaneous	9,817	8.21
Total for repair and maintenance	120,267	100.00
Other Causes		
General piping	6,610	38.35
Boiler room	767	4.45
Plant electrical	3,848	22.32
Outside electrical	215	1.25
Miscellaneous	5,796	33.63
Total for repair and maintenance	17,236	100.00



Relative cause of turbine outage

Outage records for 276 large turbine units

Summary of 1929 operating records, per cent of total period hours (8,760 hr. = 1 yr.)


Number of Years in Operation
Av. 4 Units-21,750 Kw. 39.01 Operated 52.04 Reserve 44.76 97.28
Av. 6 Units-25,166 Kw. 33.62 Operated 46.01 Reserve 35.88 99.58
Av. 7 Units-26,428 Kw. 29.44 Operated 49.56 Reserve 37.87 98.42
Av. 5 Units-20,000 Kw. 32.69 Operated 59.89 Reserve 29.92 100.00
Av. 14 Units-30,714 Kw. 37.78 Operated 63.31 Reserve 25.60 95.31
Av. 15 Units-32,530 Kw. 30.66 Operated 54.73 Reserve 35.65 96.10
Av. 19 Units-27,605 Kw. 33.98 Operated 55.93 Reserve 33.17 97.00
Av. 17 Units-26,705 Kw. 41.80 Operated 60.40 Reserve 33.06 99.10
Av. 13 Units-31,500 Kw. 40.80 Operated 65.65 Reserve 24.49 98.50
Av. 15 Units-29,500 Kw. 42.55 Operated 60.50 Reserve 29.75 99.08
Av. 33 Units-29,439 Kw. 43.34 Operated 64.72 Reserve 26.68 94.57
Av. 54 Units-32,540 Kw. 49.19 Operated 68.20 Reserve 21.18 97.36
Av. 16 Units-39,834 Kw. 65.59 Operated 84.77 Res. 5.99 94.40
Av. 26 Units-43,770 Kw. 60.14 Operated 77.18 Reserve 14.70 97.37
Av. 15 Units-42,050 Kw. 60.83 Operated 81.76 Res. 9.67 97.00
Av. 26 Units-65,430 Kw. 50.98 Operated 79.35 Res. 8.69 92.01
Service Demand Availability Factor-(Ratio of Total Service Hours to Demand Hours)
0 10 20 30 40 50 60 70 80 90 100
Per Cent of Period Hours
Capacity Use-The Ratio of Kw.-Hr. Generated to the Unit Rating Times Period Hours
Operating Time
Other Outage
Turbine Outage
Generator Outage
Condenser Outage

High-Pressure and High-Capacity Machines Show Good Operating Records (1929)

	Pressure 550 Lb. Gage or Above	Capacity 50,000 Kw or Above
Turbine units reviewed	17	42
Average capacity of units, kw.	64,880	69,330
Service demand factor, per cent	86.05	77.59
Service demand availability factor, per cent	96.90	93.86
Unit capacity factor, per cent	60.66	49.81
Unit output factor, per cent	68.75	64.12
Service hours factor, per cent	83.34	74.14
Turbine outage factor, per cent	4.76	7.04
Generator outage factor, per cent	1.17	1.57
Condenser outage factor, per cent	4.48	3.61
Other causes outage factor, per cent	1.83	2.02
Reserve hours factor, per cent	4.42	11.62

was 15 per cent, showing that the higher-service-factor-class machines are well under the average total outage factor for 1929. This seems to indicate that the continuous starting and stopping of units influences their availability.

The 1929 outage record for turbines was decidedly better than that of 1925. However, the outage factor for machines with one or two years of service is higher than that for turbines with three to fifteen years of service. The generator outage factor is quite a low value, but the curve shows an upward trend for turbines of one and two service years. In connection with the condenser, 76 per cent of the total outage is due to tube cleaning, with 11 per cent charged against the unit at a time when it should have operated for best station economy. The number affected by tube troubles, however, decreased from 23.7 per cent in 1928 to 19.6 per cent in 1929.

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Service and Meter Costs Cut by Practices Beyond the Code*

By D. M. THOMAS
Binghamton (N. Y.) Light, Heat & Power Company

WE HAVE very nearly reached saturation in wiring of houses throughout the United States and it is apparent that increase in residential revenue must come through addition of load to existing customers. An immense field exists here for the sale of appliances, and those of the major class, such as ranges and other heating devices, are particularly desirable. All this load building necessitates large capacity service entrances on new installations and replacement of inadequate 30-amp. entrances on existing installations.

In order to be attractive, the cost must be low to the new consumer who doesn't see that he will ever want to use heavy-current-consuming devices and to the present consumer to whom the excessive cost of rewiring discourages the purchase of equipment in mind.

Some activities of this nature of which I have learned follow:

Detroit Edison Company has been for some time past campaigning electric ranges and has, to make the proposition attractive, absorbed considerable of the cost of rewiring required by the additional load. This company is fortunate in being within the jurisdiction of an inspection department which appears eager to co-operate in experimenting with new methods and devices which are beyond present National Electrical Code limitations.

A 60-amp. service entrance for a range installation in Detroit consists of 1-in. service conduit inclosing two No. 4 rubber-covered wires and one bare No. 6 wire. The grounding conductor in the "Romex" range run is also bare. The entrance switch is furnished by the company and includes a dead-front distribution panel range circuit and four 15-amp. circuits—all this mounted on a metal meter board.

There are two conflictions with the code on the service in this case:

First—The code requires 1¼-in. conduit for two No. 4 wires; however, the fill is only 41.5 per cent and the code actually requires fills much higher than this in its standard table, Article 503-Q, and 41.5 per cent is less than the space required for three No. 6 wires in 1-in. pipe, which recently was approved for short runs.

Second—The bare neutral conflicts with code requirements. Irrespective of the controversial points of the bare neutral service, there is absolutely no engineering argument against the bare neutral service on a grounded system, wherein every effort is made electrically to connect as solidly as possible the neutral wire and the conduit as soon as they enter the service entrance switch cabinet. It is patently absurd to have the neutral wire and the conduit electrically bonded together in the switch and insulated with rubber in the service run to the weatherhead or outside connection to the distribution system.

The bare ground wire differs from code requirements and there are three possible objections:

Mechanical Strength.—The bare ground wire installed in accordance with the company's specifications is stronger mechanically than two of the methods pemitted by the code and is at least equal to ½-in. conduit inclosing No. 8 wire.

Electrical Hazards.—There is no electrical hazard in omitting insulation from the ground wire. This is recognized in the code by permitting the use of bare wire in conduit wherein it is bonded to the conduit at the meter switch and again at the point of attachment to the water system. It is further observed that the water pipe to which the ground wire is attached will be at the same potential as the ground wire, and under the common practice of grounding to the water mains, every time one touches the water pipe, they are in effect touching the ground wire.

Fire Hazard.—Due to the larger copper capacity and the increased radiation the bare ground wire will carry equal or greater currents for a longer time than any of the methods permitted by the code before opening the circuit or setting fire to the wooden portions of the house structure to which it is attached.

I understand that the Detroit Edison Company during its recent campaign sold "Electrochef" ranges installed at a price of $100 to the customer. I do not know exactly how much of the installation cost was absorbed by the company.

West Penn Power Company engineers are experimenting with what they call a flexible entrance assembly. One design which they have in mind consists of rubber-covered service wire inclosed in copper tubing similar to that which is being used in many cases to revamp the plumbing in old houses. They also have in mind using a meter and entrance switch which comprises at the top a connection block assembly and immediately below in a separately inclosed section a combination of dead-front pull-out, 60-amp. cartridge fuses which are used as an entrance switch and, below that, four 15-amp., two-wire circuits and one 60-amp., three-wire circuit. The sequence of connection in this case is service, connection block, meter, connection block, entrance fuse and branch circuits. This company has, since April, 1930, installed, at no expense to the customer, a 60-amp., three-wire en-

**Excerpts from "Electric Service and Meter Installations" as presented by Mr. Thomas before the recent electric meter section meeting of the Empire State Gas and Electric Association.*

trance for those who agree to use an electric range of a capacity requiring such an entrance.

Consumers Power Company at Michigan, and I believe this applies to other companies operating in the Allied Power group, are designing equipment for use on the inside end of the service conduit which will provide for connection and disconnection of the watt-hour meter only. This device is sealable and I understand is to be supplied by the company. I believe the company's interest in the electrical installation ceases at this point, as it is its idea to permit the customer to install any type of entrance switch and branch circuit device which he may select.

The Buffalo General Electric Company quite some time ago began, I believe, a design of a connection block and cabinet which would serve much the same purpose as that just mentioned.

Some new-business departments proceed to tell the contractors of the territory the limit as to what they will pay for the installation of ranges they sell, and the figure in these cases is so low as to leave the contractor a very small margin of profit. This does not make the business attractive to him, nor does it tend to improve company-contractor relations.

A more effective way used by other companies to reduce cost of electrical installations is to select one or two of a group of local contractors, giving these contractors all the work on the company range sales for a certain definite period of time. This permits the contractor to buy material on a quantity basis and on the average make installations at a slightly lower figure.

The Binghamton division of the Associated Gas & Electric System has made an effort to replace, as far as possible, existing material with that which would cost less both from a material and labor standpoint. (ELECTRICAL WORLD, page 124, July 19, 1930, "Service Installation Cost Reduced 50 per Cent.")

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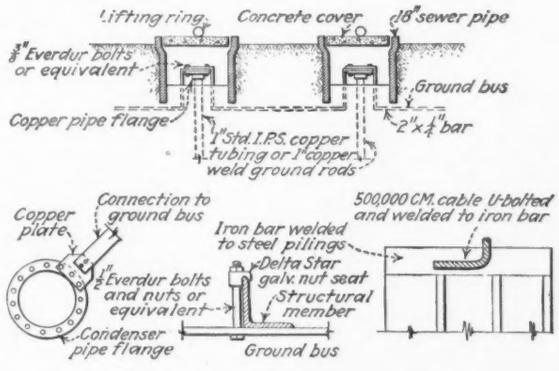
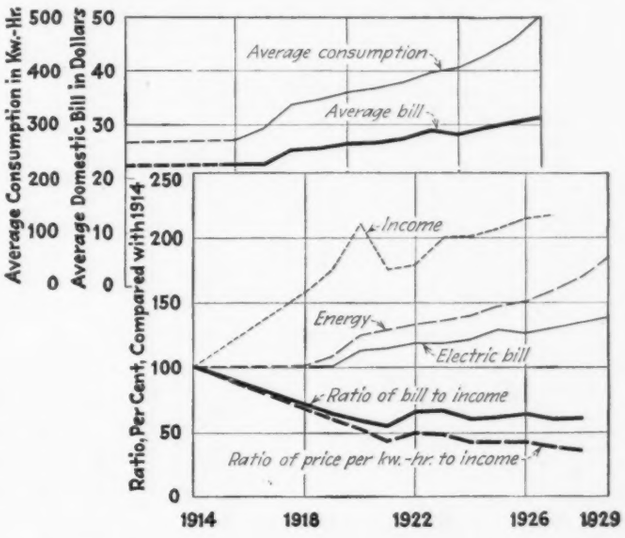
Facilitating Inspection of Ground Rods


Lifting ring
Concrete cover
18" sewer pipe
⅝" Everdur bolts or equivalent
Ground bus
Copper pipe flange
2"x¼" bar
1" Std. I.P.S. copper tubing or 1" copper weld ground rods
Connection to ground bus
Copper plate
500,000 CM. cable U-bolted and welded to iron bar
Iron bar welded to steel pilings
Delta Star galv. nut seat
½" Everdur bolts and nuts or equivalent
Structural member
Condenser pipe flange
Ground bus

So that ground rods can be readily located for inspection the Powerton station of the Super-Power Company of Illinois places over the head of each rod an 18-in. sewer pipe, its large end up and fitted with a concrete cover. The rod is capped with a copper pipe flange to which the flat bars of the ground bus are bolted. The other details show how the ground bus is connected to piping, sheet-steel piling and structural members.

Domestic Electric Bill Claims Smaller Share of Income

THE present-day domestic consumer spends a much smaller portion of his income for electrical energy than did his predecessor of 1914. Although his bill has increased, his income has grown at a much greater rate.



Average annual consumption doubled, while electric bills take smaller share of income than formerly

Proportionately, his electric bill is only 60 per cent of what it was sixteen years ago. If in addition the decreasing price per kilowatt-hour is taken into consideration, the proportionate cost per unit of energy falls to 37 per cent, compared with 1914.

These relationships are brought out in a recent study by Stone & Webster and Blodgett, of which the results are here presented graphically. It is pointed out that the average annual income of the wage earner and salaried man, who may be considered typical of the domestic consumer, increased 117 per cent from 1914 to 1927. His bill meanwhile increased only 31 per cent. Later income statistics are not available, but in view of the prosperity of these years it is probable that income has at least kept pace with the electric bill.

The study expresses the conviction that this heretofore favorable development of home electrification and cost will continue. It goes on: "The growing number of appliances, the rapidly increasing electrification of farms, the unsatiable demand for greater luxuries of lighting and other home conveniences, all such factors tend to a further and constant swelling of the domestic load and make additional economies possible, also through interconnections of power systems. Reduction of rates, therefore, may be considered a never-ending process, and there is enough evidence at the present time that the average domestic rate per kilowatt-hour, which had sunk to a low of 6.18 cents in 1929 from 8.3 cents in 1914, will reach lower figures during the current and following years."

320 Kw. for Lighting F

Every play and even expressions on players' faces visible at Dinan Field night games

Six towers 100 ft. high support lighting equipment

Twelve units on each side of field total 320 kw.

Special reflectors used

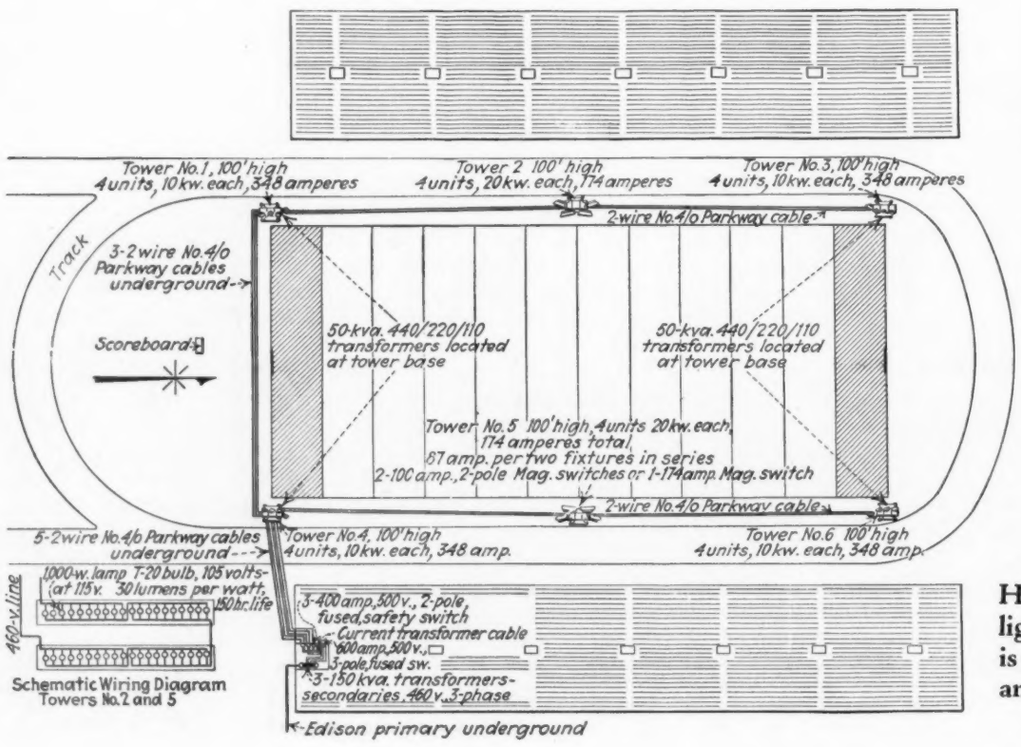
1,000-watt lamps operated at 10 per cent overvoltage

Installation cost $25,000

THE highest punt, the longest pass, the most difficult of shifts—yes, even the expressions on the players' faces, all were clearly visible to the spectators at the season's opening game of the University of Detroit played at night on Dinan Field in Detroit. This game, played under a lighting system employing 320,000 watts, not only proved the value and practicability of high-intensity lighting for night football but also demonstrated its drawing power, as the attendance was twice that obtained at any daylight game on the field. The designers of the lighting installation, E. F. Labadie, electrical engineer of the Fisher Body Company, and Harry Martin of Martin & Gibson, Detroit, abandoned all precedent when they approached their job. They figured that to light the field adequately they would have to install units of a size that might seem startling and use a lot of electricity to operate them. And that is just what they did.

After many trials and considerable research a reflector to contain twenty 1,000-watt lamps was built by the Martin & Gibson Company for side field lighting and was found on trial to be entirely satisfactory. Because of its broad distribution, this unit was not so good for use at the ends of the field, for here it not only lighted the playing area but considerably more adjacent to it, and additional equipment was therefore designed. This second unit, made by the same company, houses one 10,000-watt lamp. The units are named, respectively, Titan No. 1 and Titan No. 2.

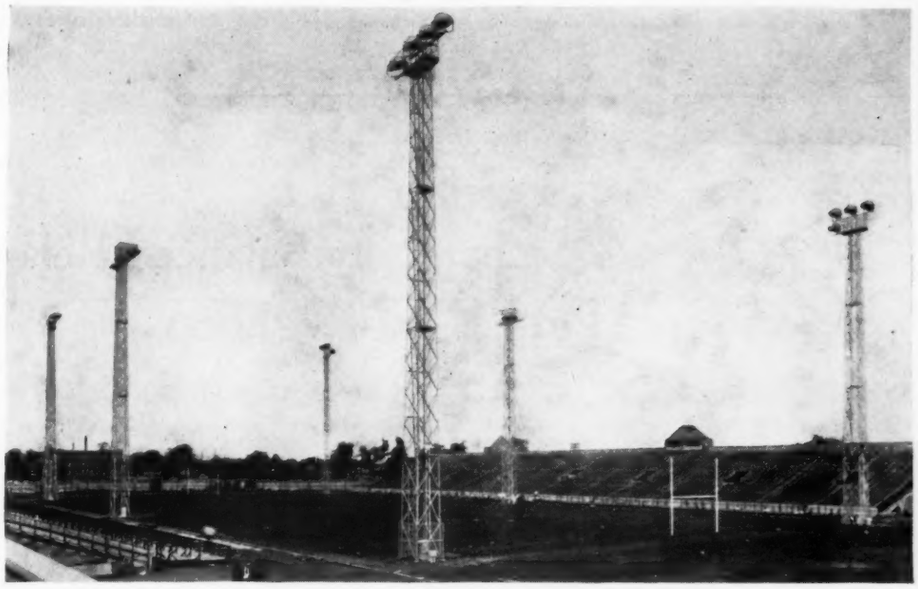
The connected load is 320 kw. Service is three phase from the Detroit Edison primary system stepped down to 460 volts through a bank of three 150-kw. transformers. The 80 lamps in the units on each of the center towers are connected in series-multiple directly on 460 volts, while at the base of each of the four end towers is a 460/115-volt, 50-kw. transformer for the four 10,000-watt lamps on each. The entire system operates at an efficiency of 30 lumens per watt; the 10-kw. lamps operate at approximately normal life, while the 1,000-watt lamps are burned at 10 per cent overvoltage, thus making the life of the entire system approximately 100 hours, and thereby facilitating maintenance, as theoretically all the lamps will need replacing at the same time.


Tower No.1, 100' high
4 units, 10 kw. each, 348 amperes
Tower 2 100' high
4 units, 20 kw. each, 174 amperes
Tower No.3, 100' high
4 units, 10 kw. each, 348 amperes
2-wire No.4/o Parkway cable
Track
3-2 wire No.4/o Parkway cables underground
Scoreboard
50-kva. 440/220/110 transformers located at tower base
50-kva. 440/220/110 transformers located at tower base
Tower No.5 100' high, 4 units 20 kw. each, 174 amperes total, 87 amp. per two fixtures in series
2-100 amp., 2-pole Mag. switches or 1-174 amp. Mag. switch
2-wire No.4/o Parkway cable
5-2 wire No.4/o Parkway cables underground
Tower No.4, 100' high
4 units, 10 kw. each, 348 amp.
Tower No.6 100' high
4 units, 10 kw. each, 348 amp.
1000-w. lamp T-20 bulb, 105 volts (at 115 v. 30 lumens per watt, 150 hr. life
460-v. line
3-400 amp., 500 v., 2-pole, fused, safety switch
Current transformer cable
600 amp., 500 v., 3-pole, fused sw.
3-150 kva. transformers-secondaries, 460 v., 3-phase
Edison primary underground
Schematic Wiring Diagram
Towers No. 2 and 5

How the lighting equipment is arranged and served

Football Field

By JAMES M. KETCH
General Electric Company, Nela Park, Cleveland, Ohio



Lights on six towers

On each side of the field are three 105-ft. steel towers, specially designed to withstand a 100-mile gale. These towers are anchored to concrete foundations, some 3½ ft. square, sunk approximately 4 ft. in the ground. On each of the four end towers, which are opposite the goal post, are mounted four Titan No. 2 units. Three of these units are mounted on trunnion bases, which are in turn fastened to a bar secured to the top rail of the platform. The other unit is fastened to a bar which is secured to the floor of the platform. On the center towers, which are on the 50-yd. line, are mounted four Titan No. 1 units. Two of these units are attached to a bar which in turn is secured to the inside top rail of the platform. In order to eliminate shadows the tower units were not mounted directly beneath, but were fastened in a like manner to a bar secured to the floor of the platform on the side facing the stands.

The problem of maintenance has been given considerable forethought on the part of the designers. Steel ladders running up the inside of the towers connect to platforms located directly beneath the units. The end units, mounted on a trunnion base, may, by merely loosening a nut, be swung around, thereby permitting easy access to the lamps. The top units on the center towers are easily accessible from a maintenance standpoint, but not so the lower ones. Here it is necessary, and design foresight has made it possible, to swing the units around, tilt them and replace the end lamps, thereby doing away with the hazard of having to climb out on the reflector to reach the end lamp.

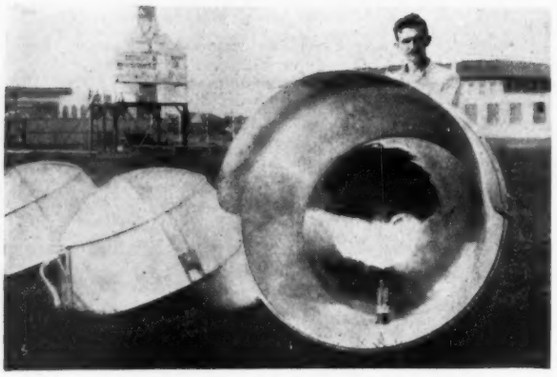
To illuminate the stands and aisle design ingenuity had to overcome another difficulty. The stands are lighted to an intensity of approximately 10 foot-candles, and this is done by means of the regular field equipment. The Titan No. 1 unit has been so designed as to light both fields and stands with the maximum intensity directed on the field. This has been done by making the reflector cut-off such that it includes both the stands and the entire playing area to the opposite side of the field. This is possible where a high mounting prevails, otherwise glare would result.

The aisles leading from the various entrances to the stadium proper are lighted to a satisfactory intensity by means of 200-watt lamps in Holophane 832's spaced 30 ft. apart. This system is separately controlled from the field lighting.

Minor electrical trouble may temporarily drop the cur-

Reflector for twenty 1,000-kw. lamps

This reflector, 8 ft. at the top, 6 ft. at the bottom, with a depth of 16½ in., is made of aluminum, the inside surface being oxidized. A chromium-plated spun copper mirror picks up the light given off by the lamps and directs it onto the field. The reflection surface is supported by and fastened to an exterior frame composed of structural steel members welded together into one unit.

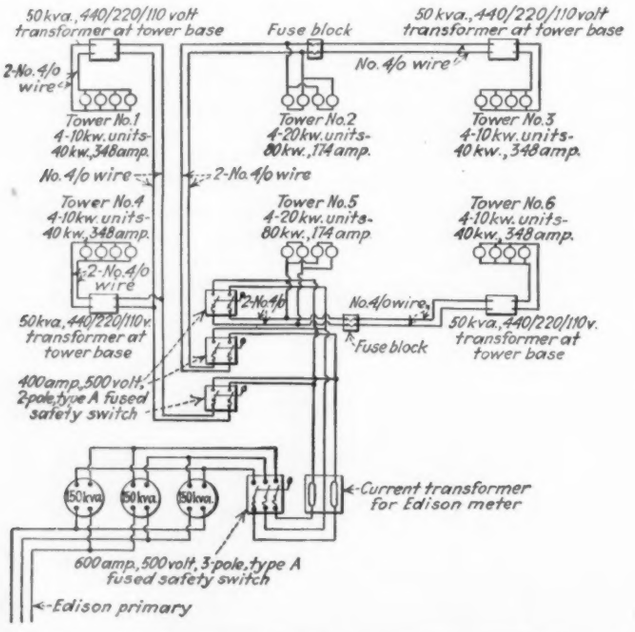


Reflector for 10-kw. lamp

This reflector, with a mouth width of 4 ft. and a depth of approximately 2 ft., consists of a 36-in. parabolic mirror, the reflecting surface being oxidized aluminum. The aluminum reflection surface is folded over a structural steel frame with all the joints welded together to make it weatherproof.

tain of darkness over many a gathering of night football enthusiasts, but not so at Dinan Field. An auxiliary lighting system, consisting of two 20-in. RLM domes per tower and each equipped with 1,000-watt lamps, burns throughout the game and, being independent of the regular system, makes this possibility an improbability and thereby eliminates the likelihood of petty thievery and perhaps riots, should the field and stands be suddenly plunged into darkness.

Night football is here to stay, it has proved itself a paying proposition for the high schools, colleges and universities whose teams play a night schedule, and while many of the smaller schools have and will continue to install smaller installations than the $25,000 one described above, it is readily apparent that the installation by other large colleges of a lighting system equivalent to the one at Dinan Field will not only be a paying investment but will bring to the football lover the best the electrical industry has at present to offer, and to the central station a heretofore undreamed-of load possibility.


50 kva., 440/220/110 volt transformer at tower base
Fuse block
50 kva., 440/220/110 volt transformer at tower base
2-No. 4/0 wire
No. 4/0 wire
Tower No. 1 4-10 kw. units- 40 kw., 348 amp.
Tower No. 2 4-20 kw. units- 80 kw., 174 amp.
Tower No. 3 4-10 kw. units- 40 kw., 348 amp.
No. 4/0 wire
2-No. 4/0 wire
Tower No. 4 4-10 kw. units- 40 kw., 348 amp.
Tower No. 5 4-20 kw. units- 80 kw., 174 amp.
Tower No. 6 4-10 kw. units- 40 kw., 348 amp.
2-No. 4/0 wire
2-No. 4/0
No. 4/0 wire
50 kva., 440/220/110 v. transformer at tower base
Fuse block
50 kva., 440/220/110 v. transformer at tower base
400 amp., 500 volt, 2-pole, type A fused safety switch
150 kva.
150 kva.
150 kva.
Current transformer for Edison meter
600 amp., 500 volt, 3-pole, type A fused safety switch
Edison primary

Series-multiple connections save two transformers

The two south end towers are controlled together on one phase with a 400-amp. switch. The feeder from the switch to the transformer at base of towers is two-wire No. 4/0 parkway cable. From the transformer at the tower base to the four 10,000-watt units the feeder size is two No. 4/0 weatherproof cable per leg. The east, center and northeast towers are controlled together from one 400-amp. switch. The feeder from the switch to the center tower consists of two two-wire No. 4/0 parkway cable tied together at both ends. At base of tower a fused tap is made and one two-wire No. 4/0 parkway cable carries the energy to the north tower. The west, center and northwest towers are controlled together in identically the same manner as the above-mentioned ones. The diagrams give additional wiring details.

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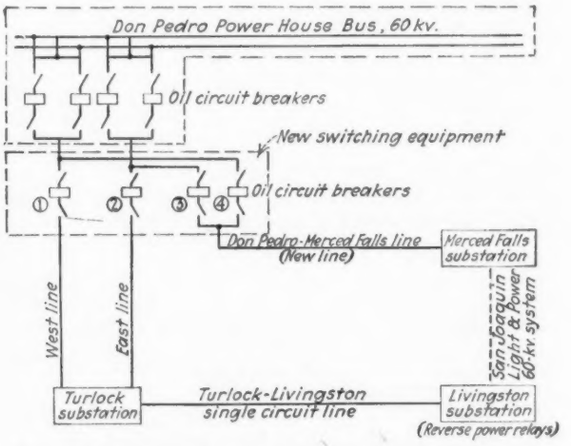
Mechanically Balanced Relays Protect 60-Kv. Loop

By M. M. McINTIRE

Electrical Engineer Imperial Irrigation District, Imperial, Calif.

When the capacity of the Don Pedro plant of the Turlock (Calif.) Irrigation District was more than doubled in 1928, it was considered desirable to complete a loop in the 60-kv. transmission system to provide a more reliable means of delivering energy wholesale to a privately operated utility. It was necessary, however, to provide a sure means of isolating faulty lines in case of trouble. The existing system as well as the new line is shown in the accompanying diagram.

It would have been possible to connect the new line through oil circuit breakers to either of the existing main lines, but it was impossible to connect it to the power house bus owing to lack of space for circuit breakers. Accordingly, oil circuit breakers were installed in each main 60-kv. line near the power house and provision made for tying the new line in with either through oil circuit breakers as shown. Main line breakers (1) and (2) could have been omitted, but in that event a fault on the main line between the power house and Turlock



How instantaneous relaying of faulty 60-kv. loop line is provided

would have put the whole delivery to the private company out. A three-phase a.c. circuit and a d.c. tripping circuit were run from the power house for remote control of all four breakers.

Under normal operating conditions both main line breakers are closed and the new line tied in through one of the breakers so that a loop will be formed with the particular line which happens to be supplying Livingston substation of the private utility. These breakers are all provided with bushing type current transformers, which are used to actuate General Electric type PD-3 mechanically balanced, current-differential relays, one set (1) and (4) for the west line and one set (2) and (3) for the east line switches. The action of these relays is dependent upon a differential current as a result of a fault on one of the lines of the loop. The relay selects the faulty line and trips it out instantaneously while reverse power relays are opening the loop on the private company's section of the line.

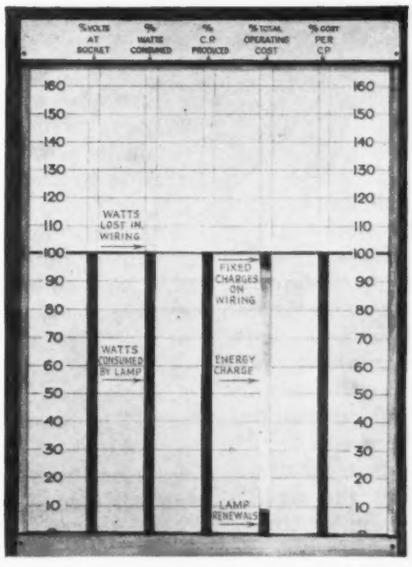
Overload relays could, of course, have been used, but it was desired that there should be no interruption to the deliveries to the private company and that faults should not disturb the line any more than could be avoided. Since the installation of this equipment in 1928, there have been several faults on each line and in every case the relay system has functioned perfectly. The action of the relays has been so prompt that in every instance the first warning of the outage was the flashing of the signal light in the power house and indications on the voltage charts were hardly noticeable.

▼ ▼ ▼

What Happens to Lighting Cost When Socket Voltage Is Incorrect

If through inadequate wiring or use of overvoltage lamps the ratio of socket voltage to lamp voltage is reduced, the energy consumed, the candle power and the lamp renewal cost are reduced, but the cost per candle power delivered is greatly increased. On the other hand, if the ratio of socket voltage to lamp voltage is increased the energy consumption, candle power delivered and lamp renewal cost increase. With 5 per cent overvoltage at the socket, however, the total cost per candle power delivered is reduced nearly 4 per cent. Beyond this value the total cost per unit of light increases.

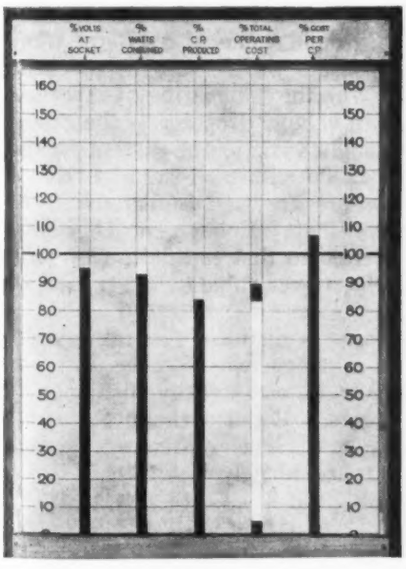
The illustrations, which represent photographs of animated voltage charts devised by G. S. Merrill, Nela Park engineering department, General Electric Company, showing total illumination cost per candle power delivered and component costs, are based on the following assumptions:

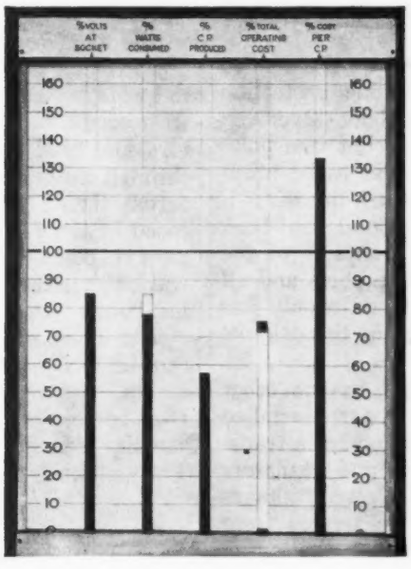


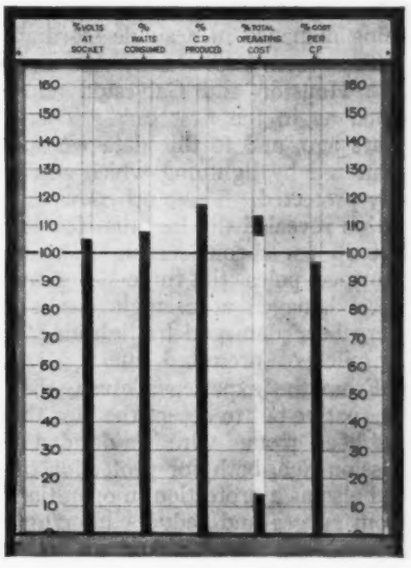
Cost of light figured for case as follows: 200-watt lamps cost 75 cents installed in socket (this would represent purchase under a $600 contract with a handling charge of 14.2 cents per lamp). Energy costs 4 cents per kilowatt-hour (this should include demand charges), 1,500 hours use per year. Cost of wiring, per outlet,

$$= \$9.55 \left(\frac{\text{watts}}{100 \times \text{drop}}\right)^{0.37}.$$

This relation was derived from data given in the report of the adequate wiring subcommittee of the N.E.L.A., Lighting Service Manual, Part III, August, 1928. Fixed charges on interior wiring (interest, taxes and depreciation) 12 per cent per year. Mechanical breakage (one lamp each 10,000 burning hours) has been included.







READERS' FORUM

Contests Statement

To the Editor of the ELECTRICAL WORLD:

In the article "Requirements of Twenty Processes that Generator Voltage Control Meets," by S. Martin, Jr., our engineers feel that part of the statement referring to paper machine drive might be misleading. The following is quoted from the July 26 issue:

> For paper machines with a wide range of speeds and paper weights, a generator is required for each sectional drive motor . . . . This equipment gives a range in speed and weight of paper of at least 10 to 1.

As you probably know, separate generators are by no means necessary, and usually complicate the layout. We have jobs running where one generator furnishes power for all the individual sections operating on 10:1 speed range.

HENDLEY N. BLACKMON,
General Engineer.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

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Convinced of Protection from Ground Wires

To the Editor of the ELECTRICAL WORLD:

This company at first built a 50-mile pole line between Houston and Galveston with the power station at the midway point. A 33-kv. transmission line extended a distance of about 13 miles in each direction, terminating in railway substations, and was protected by an overhead ground wire hung on pole bayonets about 4 ft. above the pole tops, with an earth ground every 600 ft. The remainder of the pole line at each end carried only the trolley, feeder and telephone lines and had no such protection. Almost from the beginning there was trouble in the unprotected sections from pole tops being shattered by lightning, necessitating in some cases the replacement of poles, while in the protected section no trouble was experienced whatever from lightning. In one section near Galveston Bay the poles were particularly susceptible to damage, as many as three successive poles being damaged in a single storm.

Two years later the transmission lines were extended into Houston and Galveston and the same protection given as in the first case. This was about seventeen years ago, and to this date we have had but two poles shattered by lightning which could be said to be properly protected. Three others were damaged, but investigation revealed the fact that the earth grounds had been left off for a considerable distance on each side of the damaged poles, the three being successive poles and all were damaged at a single stroke. One time only has there been damaged by lightning a pole in the original 26 miles of protected line.

From the experience given, the writer has no other alternative but to accept the idea that a properly installed overhead ground wire is a decided protection for a transmission line, both for protection of poles and insulators and also as a protection in operation, as it lessens outages from surges and reduces interruptions to service from damaged insulators. And we believe in it to the extent that on all angle poles and those of unusual height an individual earth ground has been placed to lessen the possibility of having to replace such poles which require an unusual amount of trouble, labor and expense. It would seem that where trouble is experienced from lightning damage to grounded poles it would be advisable to look to the quality of the grounding used. A year ago this company renewed about 25 miles of overhead ground wire because of the protection it affords.

C. L. GREER,
In Charge of Overhead.
Galveston-Houston Electric Railway,
Houston, Tex.

▼

Airplane Guide and Obstruction Marker

To the Editor of the ELECTRICAL WORLD:

With a view to simplicity in construction and economy of operation, a neon light marker unit for marking radio towers, smokestacks, tall buildings, transmission lines and other obstacles to aviation was developed. The light unit proper consists of six U-shaped neon tubes connected in series and mounted under a conical hood. Each neon tube is protected by a cut-out and should one become defective for any reason it is automatically shorted out. A large factor of safety is thus afforded, for should even five tubes fail, the remaining tube will still burn.

Two types of marker are available: Type LT to obtain its power from a low-voltage supply and type HT to obtain its power from a high-voltage supply as a transmission line. The LT type consists of the light unit proper (hood and tubes), with a transformer mounted underneath the canopy. This unit was primarily designed for use where only a low-voltage supply is obtainable, such as in the marking of tall stacks, radio towers, church steeples and bridges. The HT type consists of the light unit proper with a number of coupling capacitors, the number of capacitors depending upon the line voltage. (The light unit is not directly connected to the line, as indicated in the August 30 issue, page 416.) The capacitors are connected in series with the neon tubes between the line and ground. The series current through the tubes is limited to 25 milliamperes. As the neon tubes are virtually a straight resistance load, the voltage across them is vectorially about 90 deg. out of phase with that across the capacitor units. The tube voltage of 3,000 is relatively small as compared to the average line to ground value of a typical transmission line and this permits various lengths of tubing to be operated in series with the same string of capacitors with very little change in voltage drop across the capacitors, and hence a very slight variation of current flowing through the neon tubes. To withstand the high voltage across them, the capacitors are well insulated and incased in wet-process porcelain. Enough capacitor units may be connected in series so that the flash-over value will be as great as the flash-over value of the suspension insulators.

This neon marker forms a distinctive warning which can be easily seen at a distance of 5 miles on clear nights. Its reddish glow is very readily distinguished from other ground lights. Because the neon tubing actually generates red light, it is extremely efficient. The marker consumes approximately 100 watts.

H. C. LEIMER,
Supply Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Men of the Industry

COUNT GIUSEPPE VOLPI DI MISURATI, chairman of the board of directors of the European Electric Corporation, Ltd., and formerly Italian Minister of Finance, arrived in New York, November 9, on the Cosulich liner *Vulcania*. Count Volpi is the chairman of or a director in twenty of the largest Italian public utility and industrial corporations. During his stay of a month in this country he will confer with American banking and public utility executives.

•

C. E. DOVE, formerly assistant general manager of the Interstate Power Company, Dubuque, Iowa, is now general manager of the Newport Electric Corporation. Mr. Dove was connected with the public utility industry in the Middle West for a number of years. He was for six years manager of the Indiana Power Company at Vincennes before removing to Dubuque in 1924 as general manager of the Dubuque Electric Company.

•

C. C. CORNELIUS has been appointed superintendent of overhead engineering of the Kansas City (Mo.) Power & Light Company to succeed B. R. Stocks, who has assumed new duties in St. Louis. Mr. Cornelius is well qualified to direct the work of this department, having been a guiding figure in its operations for the past ten years. He is a native of Maysville, Mo., and a graduate of the University of Missouri. Mr. Cornelius is a member of the American Institute of Electrical Engineers and of other engineering associations.

•

J. GARDNER MENUT has been appointed manager of the Capital division of New York Power & Light Corporation with headquarters in Albany. Mr. Menut, who was formerly assistant to Mr. Haley, assumed his new duties November 1. As manager of this division, Mr. Menut will supervise the operating activities, both gas and electric, throughout the Capital division. During his wide and varied career Mr. Menut has filled important positions in public utilities in New Hampshire, Vermont, New York, New Jersey, Pennsylvania, Maryland, South Carolina, and Florida. More recently he held managerial positions with General Gas & Electric Corporation in several Eastern States, and just previous to his association with the New York Power & Light Corporation, more than a year ago, he was assistant to the vice-president of W. S. Barstow & Company, New York City.

▼

K. W. Landry Assumes New Duties in New England

KENNETH W. LANDRY has been appointed contact engineer for the Fall River (Mass.) Electric Light Company on behalf of the southern division of the New England Power Construction Company, a subsidiary of the New England

Power Association. He will maintain a liaison between these branches of the organization in engineering and construction activities, facilitating the policy of district control, centralization of effort and technical specialization which marks the association's present expansion into the retail company field. Mr. Landry's previous service has been with the Worcester Electric Light Company as a former head of the meter department, assistant to the general superintendent, distribution engineer and later a member of the district engineering staff of the Power Association following its acquisition of the Worcester company.

▼

H. S. WARREN of the American Telephone & Telegraph Company has been named chairman of the National Fire Protection Association's committee on grounding to succeed W. H. Blood, Jr., who asked to be relieved of the duties of that office. Mr. Warren has been a member of that committee for a number of years and assumes the chairmanship with an intimate knowledge of grounding problems and of the previous work of the committee.

•

CHARLES E. BONINE, consulting engineer and a member of the firm of Bonine & Costa, Philadelphia, has been named director for engineering of the Benjamin Franklin Memorial and Franklin Institute Museum.

•

A. C. MOORHAUS, purchasing agent of the Union Gas & Electric Company, Cincinnati, Ohio, since 1924, has been made acting general manager of the company, according to an announcement made by H. C. Blackwell, president. A native of Cincinnati, Mr. Moorhaus became affiliated with the Union Gas & Electric Company six years ago, after resigning as secretary of the Scioto Valley Railway & Power Company, Columbus. W. R. FREEMAN, assistant to Mr. Moorhaus, becomes acting purchasing agent of the Union Gas & Electric Company. He has been in the employ of the company for the last four years.

•

EARLE S. HENNINGSEN has been appointed engineer of the alternating-current engineering department of the General Electric Company to succeed H. G. Reist, who has retired. Mr. Henningsen was graduated from the University of Wisconsin in 1912 and in the same year entered test with the General Electric Company. He joined the alternating-current engineering department in the following year, but in 1917 he entered military service. Mr. Henningsen returned to the General Electric Company in December, 1918, and in 1926 was made assistant engineer of the department, being assigned especially to the mechanical design of alternating-current machines and the executive work of the department. Mr. Reist was graduated from Lehigh University as a mechanical engineer in 1886 and in 1922 received the degree of doctor of engineering from that institution. He entered test with the Thomson-Houston Company, preceding the General Electric Company, at Lynn, Mass., in 1889. From then until 1894 he was foreman

of the factory winding department and was engaged on design work on direct-current machines. In 1894 he was appointed engineer of the alternating-current engineering department.

•

B. R. STOCKS, formerly superintendent of the overhead system engineering department of the Kansas City Power & Light Company, Kansas City, Mo., is now identified with the James R. Kearney Corporation of St. Louis, Mo. Following graduation from the University of Kansas, Mr. Stocks entered the General Electric Company test course and later was transferred to Kansas City. In 1915 he severed his relation with the manufacturing company to join the Kansas City utility in the capacity of electrical engineer. One of his first jobs was changing the antiquated overhead distribution system to a more modern system, this work being the nucleus of the present overhead engineering department.

•

JAMES BARRINGTON has been appointed safety supervisor for the Coast Counties Gas & Electric Company, Santa Cruz, Calif. Immediately preceding his appointment as safety supervisor he was connected with the company's meter department, and his promotion comes in recognition of his efforts along safety lines while employed in other departments. Mr. Barrington has been at the head of the Red Cross first aid work in the Santa Cruz area for the past several years, during which time he aided in instruction of scoutmasters and other similar work. As a special feature of his new work he is conducting a series of classes in the various districts of the company dealing with first aid and safety training, using the Bureau of Mines' first-aid manual as a text.

•

EDWARD WRIGHT has taken over the duties of president of the St. Lawrence County Utilities, Inc., with headquarters at Potsdam, N. Y., succeeding Frederick A. Stoughton, who resigned recently. Mr. Wright was formerly in Malone, where he was president of the Malone Light & Power Company since 1926, an office he will continue to hold. He has been associated with power interests for many years. In 1902 he was manager of the Nashua River Power & Paper Company, and was associated with the St. Regis Corporation from 1918 to 1926. As president of the St. Lawrence group of utilities Mr. Wright will have charge of the Niagara Hudson power system in Potsdam, Ogdensburg, Gouverneur, Theresa, Parishville, Heuvelton and Fort Covington. C. P. Scheller of Potsdam becomes vice-president of the St. Lawrence Utilities and the St. Lawrence Valley Power Companies.

OBITUARY

Arthur W. Thompson

ARTHUR W. THOMPSON, formerly president of the United Gas Improvement Company of Philadelphia and of the Philadelphia Company of Pittsburgh, died November 9 in the West Pennsylvania Hospital, Pittsburgh, of an acute infection of the heart, with which he was stricken in October. He was 55 years of age. For a number of years Mr. Thompson was an outstanding figure in public utility circles in the East. He became president of the United Gas Improvement Company in September, 1926, and resigned from that office in January, 1929, owing to impaired

health. Following an extended trip abroad he opened offices in Philadelphia in the fall of 1929 as a consultant.

Mr. Thompson entered the electric light and power field with a rich background of training and experience as an engineer and railroad executive when he took over the duties of chief executive of the Philadelphia Company in 1919. A native of Erie, Pa., and a graduate of Allegheny College, Mr. Thompson entered the employ of the Pittsburgh & Lake Erie Railroad in 1898. In 1899 he became identified with the Baltimore & Ohio Railroad at Pittsburgh, and advancing in the ranks he was appointed chief engineer in 1910, general manager eight months later and in the spring of 1912 he was elected third vice-president of the company in charge of operation. Subsequently he was named vice-president in charge of traffic and commercial development. Mr. Thompson's ability was recognized by the federal government when in 1918 he was appointed federal manager by the United States Railroad Administration of the Baltimore & Ohio, Western Maryland, Cumberland & Pennsylvania and Cumberland Valley Railroads, in addition to the Coal & Coke Company, the Wheeling Terminal Railway and Staten Island Lines. It was under his guidance that the Colfax power plant of the Duquesne Light Company was erected and it was he who worked out a plan for the reorganization of the Pittsburgh Railways Company. During his term as president of the United Gas Improvement Company a deal was completed which brought into the U.G.I. system the important properties of the Philadelphia Electric Company.

Mr. Thompson served at one time as a vice-president of the National Electric Light Association and was a member of the American Electric Railway Association, the American Society of Civil Engineers and of other technical associations. He had served on the directorate of numerous industrial and public utility enterprises in the course of his career.

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JOHN L. BOYLE, head of the photographic division of the standardizing and testing department of the Edison Electric Illuminating Company of Boston since 1920, died suddenly at his home in Boston on November 10. Mr. Boyle was born in Boston 47 years ago and his service with the Edison company began as a station records boy in the generating department at the age of 14. He was active in the company's Gold Button Legion of Honor, which is composed of long-service employees, and for fifteen years was on the staff of *Edison Life*, the company's official publication. Many products of his photographic skill have enriched the pages of ELECTRICAL WORLD.

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FREDERICK P. FISH, formerly president of the American Telephone & Telegraph Company, and one of the most distinguished patent lawyers in America, died at his home in Brookline, Mass., November 6 at the age of 75. Mr. Fish was a native of Taunton, Mass., was educated at the Harvard Law School and practiced law in New York and Boston until 1901, when he was elected president of the Bell telephone system, serving until 1907. He then resumed his private practice, with offices at Boston, under the firm name of Fish, Richardson, Herrick & Neave, continuing this association until the end. He was a director of many corporations and was actively identified with many educational institutions, including the Harvard University board of overseers, executive committee of the Massachusetts Institute of Technology and others. He was a past-chairman of the National Industrial Conference Board.

Financial and Statistical News

FURTHER market recession following the elections brought a representative group of twenty utility stocks almost to 1927 levels. The price-times-earnings ratio of this group stood at 19, against a 1929 high of 35, before recovery set in.

——POWER CONSUMED IN INDUSTRY SHOWS FURTHER RECESSION of about 8 per cent from September level. Almost all industry groups showed declines in varying degree.

——WHILE BROKERS' LOANS DROPPED $58,000,000 during the past week, loans of the Federal Reserve banks rose $32,000,000, suggesting a shifting of accounts from brokerage houses to banks.

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Puget Sound Power & Light Plans Recapitalization

STOCKHOLDERS OF THE Puget Sound Power & Light Company will hold a special meeting December 1 to vote on a proposed plan of recapitalization. It is suggested to change the 202,829 shares of no-par common now authorized and outstanding into 811,316 no-par common shares by issuing four new for one old common share.

It is also proposed to increase the authorized number of no-par preferred shares from 300,000 to 500,000 and the authorized number of no-par common shares from 811,316 to 2,000,000; also to reduce the authorized number of no-par junior preferred shares by 300,000. After these changes have been voted the total authorized capital stock will consist of 110,000 no-par prior preference shares, 500,000 no-par preferred shares and 2,000,000 no-par common shares.

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Midland United to Absorb American Public Utilities

SIMPLIFICATION OF CAPITAL STRUCTURE will result if stockholders of Midland United Company and American Public Utilities Company vote to have the latter absorbed by the former at special meetings to be held November 19 and 20. Under the plan Midland United would succeed to all the properties and liabilities of the other company, which would cease to exist as a separate entity.

Officers and directors of the Midland company will not be changed by the merger, nor will the company's authorized capital stock and classes of capital stock be affected. The preferred stocks of the American Public Utilities Company have been called for redemption before the merger becomes effective. Common shares of the American Public Utilities Company will be converted into common shares of the Midland company at the rate of 4.5 shares of Midland common for each share of American Public Utilities common.

Output Continues Below Last Year's

ELECTRICAL ENERGY OUTPUT, as estimated weekly by the statistical research department of the National Electric Light Association, continues to increase seasonally. The excess compared with corresponding weeks of 1928 has recently shown a slight improvement, but production remains about 4 per cent smaller than in 1929. The accompanying table gives the output for recent weeks and the change in per cent for 1930 from 1929 and 1928, respectively.

Week Ended	Kw.-Hr. 1930	Per Cent Change from 1929	1928
October 18	1,710,258,000	—3.5	+2.7
October 25	1,724,974,000	—4.1	+2.8
November 1	1,748,319,000	—4.4	+3.5
November 8	1,731,298,000	—4.4	+2.0

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Factors Affecting Legality of Utility Bonds

PUBLIC utility bonds legal for savings bank investment are sometimes taken off the "legal" list because of changes in capital structure, F. V. Henshaw, of Wood, Struthers & Company, told members of the Savings Bank Association of New York at the recent annual meeting in Quebec. In the case of railroad bonds, such removals are usually due to a decline in earnings.

"We have had a two-year test of the public utility law and one-year test of the railroad law, and it may be of interest to consider briefly the results," said Mr. Henshaw.

"Among legal bonds there are large differences in the margin over legal limits. Bonds that barely comply with the law are not only inferior, for that reason, but are obviously in the greatest danger of losing their legal position. These margins over legal requirements roughly measure relative values. Among the present legal public utility bonds, the highest grade may be illustrated by a bond showing a ratio of stock to debt of 261 per cent, as against the legal requirement of two-thirds; bonds to property 31 per cent, as against the limit of 60 per cent, and interest earned 5⅓ times, against the requirements of twice. At the other end of the scale there is a bond showing stock to debt of only 78 per cent; bonds to property of nearly 58 per cent, and interest earned 2.9 times. The choice among railroad bonds is a more simple matter for those who devote themselves to the study of corporate finance, since the position and credit of the various railroads are quite generally understandable. It is also to be noted that, as stated before, with the railroads it is largely a question of earning power, whereas with the utilities it is more a matter of capital structure.

"In selecting bonds I suggest using the legal requirements as a guide by working out the margins over these requirements. Further consideration of public utility bonds would involve some study of the history of the company and of its financial practices as revealed in the balance sheet—such things as reasonable amounts of reserves and surplus, the amount of floating debt, and, on the other side, the amount of deferred charges. Apparently many public service commissions are not at all strict in the matter of writing off discount and expense. Hence, you will find cases where these items have grown out of all reason. Naturally a company that constantly rolls up deferred charges, while paying practically everything out in dividends, is less desirable than one that is more conservatively managed.

"I am moved to express my amazement at the common practice in our

country of selling public utility bonds on the strength of a circular that does not include a balance sheet reflecting the financing. Even bonds of new companies or those that have completely changed their capital structure are sold on such kind of information—or rather lack of it. New issues of bonds of companies already in the legal class are offered in such circulars, and it is consequently impossible for the buyer to know whether or not the new issue has forfeited the legal position of the company's bonds. If you ask for a balance sheet you are repeatedly told with a smile that it does not mean anything. In your case, however, it means a great deal. I would also point out that the balance sheet of a public utility company means a great deal to anybody studying the company, since public utility accounting is a relatively simple matter and any strange item stands out at once. Furthermore, this balance sheet can be compared with the figures submitted to the Public Service Commission. Therefore, I urge you to insist upon a balance sheet and refuse the bonds if that information is not forthcoming.

Methods of selection

"I was requested to say something about the methods pursued by our largest investors, namely, the big life insurance companies, in selecting corporate bonds. The major life insurance companies are undoubtedly successful investors, though they are not infallible. Perhaps one reason why we find some bad investments on their lists is that their holdings are so large that liquidation is difficult. In that respect you have an advantage, since it is easier to get out of a block of under $50,000 bonds than it is to sell $1,000,000. These life companies have such huge amounts to invest that it pays them to maintain a special finance organization. The usual organization is something like this:

"There will be a finance committee consisting of certain trustees and one officer. Under them will be the treasurer and a special organization consisting of a railroad expert, a public utility engineering expert, and an industrial expert. This organization not only studies the facts and figures submitted, but spends a great deal of time in actual inspection of the issuing companies' management and property. Through this organization and their large funds for investment, such companies can establish a policy of building up their interests in the bonds of certain companies by making additional investments from time to time when it can be done to advantage. Obviously, the cost of such an organization is considerable and it could not be made to pay in other than a huge investing institution, and even such institutions constantly make use of outside advisers to supplement their own research.

"I have also been asked to offer some comments on the question of extending the legal list through other mediums of investment. I have heard a number of discussions on this subject and do not quite understand the reasons for opposition on the part of some savings bank officers to various proposed extensions of the legal list and of the powers of the banks. It is my assumption, and perhaps I am wrong, that the existence of legal authority, permitting the banks to do a thing, carries no compulsion. If there were no limit to the amount of a deposit, would not the banks fix their own limits? If a Massachusetts banker thinks that three-name paper is dangerous, he is certainly under no compulsion to take it. If the mutual savings banks are to hold their own in this new era, they must rid themselves of over-cautiousness, encourage all reasonable efforts to widen their powers, and be prepared to take full advantage of each new opportunity."

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Power Industry Makes Favorable Showing for Three Quarters

REVENUE of electric light and power companies in the country as a whole for the first nine months this year was well in excess of that in 1929, it appears from an analysis of figures compiled by the ELECTRICAL WORLD on the basis of monthly returns from power companies throughout the United States.

The total for all energy sales during this period was $1,588,400,000, a gain of 3 per cent over the $1,541,000,000 for the same portion of last year. The effect of the acceleration during the early part of 1929 and the retardation in 1930 is evident from the accompanying table; while this year's earnings have been consistently ahead of last year's the margin has gradually been growing narrower, until in September, with a revenue this year of $174,600,000, it was only 0.6 per cent. Any slight revision in the latter figure, that may result from the inclusion of delayed returns, will not appreciably change this conclusion.

Assuming that for the remaining three months the average will be about the same as for the equivalent period last year the total for 1930 will be not far from $2,150,000,000, leaving a gain somewhat better than 2 per cent over the $2,105,900,000 for 1929. The assumption is reasonable because by October, 1929, the industrial tide had already begun to ebb; the gain over 1928 was shrinking. Moreover, merely the normal seasonal growth over present levels will account for more than the revenue here assumed.

These statistics merely summarize, of course, what was to be inferred from published statements of numerous individual companies; the fundamental nature of the electric power industry and its extraordinarily diversified service endow it with unusual stability of income.

Meanwhile operating expenses have been held down to reasonable proportions compared with revenue, so that the gain in gross revenue has been reflected in net. Reduced fuel consumption alone, due both to greater plant efficiency and to diminished demand for energy, has brought savings on the order of $1,000,000 a month. But for the unusual drought the saving would have been even greater.

Comparative Revenue

Month	1930	1929	Per Cent Change
January	$198,300,000	$187,000,000	+6.0
February	185,800,000	176,800,000	+5.0
March	176,200,000	170,500,000	+3.3
April	176,300,000	170,900,000	+3.2
May	172,900,000	168,400,000	+2.7
June	169,200,000	165,300,000	+2.4
July	167,000,000	162,300,000	+2.9
August	168,100,000	166,200,000	+1.1
September	*174,600,000	173,600,000	+0.6
Total nine months	$1,588,400,000	$1,541,000,000	+3.0
October		182,500,000	
November		190,200,000	
December		192,200,000	
		$2,105,900,000	

*Subject to revision upon inclusion of delayed returns.

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NEWS BRIEFS

Supplementary letters patent, recently issued, increased the capital of the Middle West Utilities Company of Canada, Ltd., from 25,000 to 50,000 shares of $100 par preference stock and from 325,000 to 500,000 shares of no-par common stock.

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Delaware Electric Power Company has filed a certificate at Dover increasing the authorized capital stock (no par value) from 500,000 shares to 1,000,000 shares.

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Louisville Gas & Electric Company has called for redemption on December 1 sinking fund 6 per cent gold debenture bonds, series A, dated October 1, 1922, to the amount of $74,800.

Industrial Index Slides Downward

NEARLY every industry group curtailed operations in October, compared with September, it appears from reports of energy consumption in industrial establishments throughout the country received by the ELECTRICAL WORLD. After a slight rise during August and September from the July minimum the weighted average for October fell to the lowest value since December, 1926, when an equally low point was reached for a single month.

The October index is 2.0 per cent below the July figure, 6.5 per cent below that for September and about 23 per cent lower than it was a year ago. For the first ten months the average is about 15 per cent lower this year than in 1929.

Exceptions to the downward movement are found in textiles, paper and pulp, iron and steel plants, and leather products. The first two continued with negligible changes from September; although leather products rose, the change loses its significance when comparison is made with any month other than September; the index is still down 3 per cent from August.

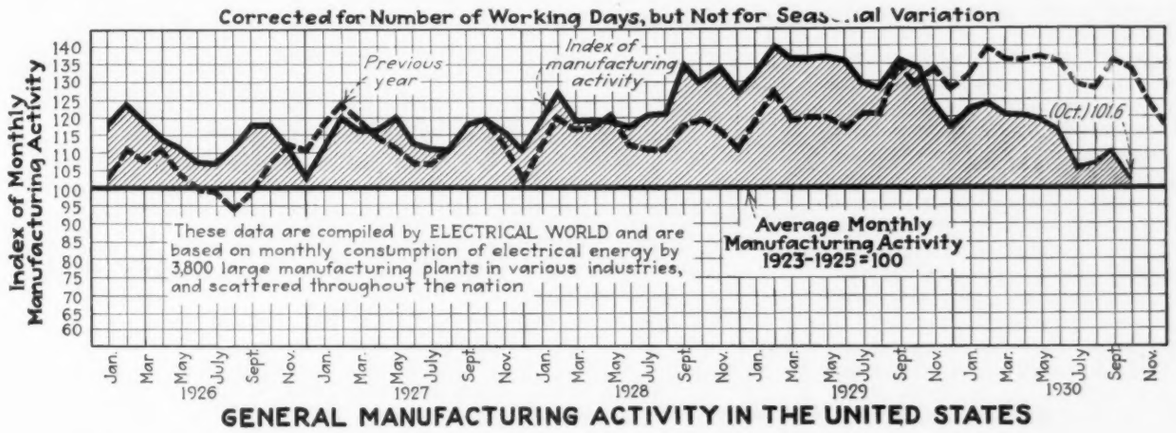
In the combined group of metal industries, composed of the iron and steel plants and metal-working plants taken together, there was a drop of 0.8 per cent, as is shown in the chart. Metal-working fell but steel gained strongly.

In only one group, food products, was there a gain compared with 1929 in the October index. Rubber fell with automobiles. For the first ten months the greatest downward change, 34.8 per cent, was in automobiles and parts. The table gives additional comparisons.

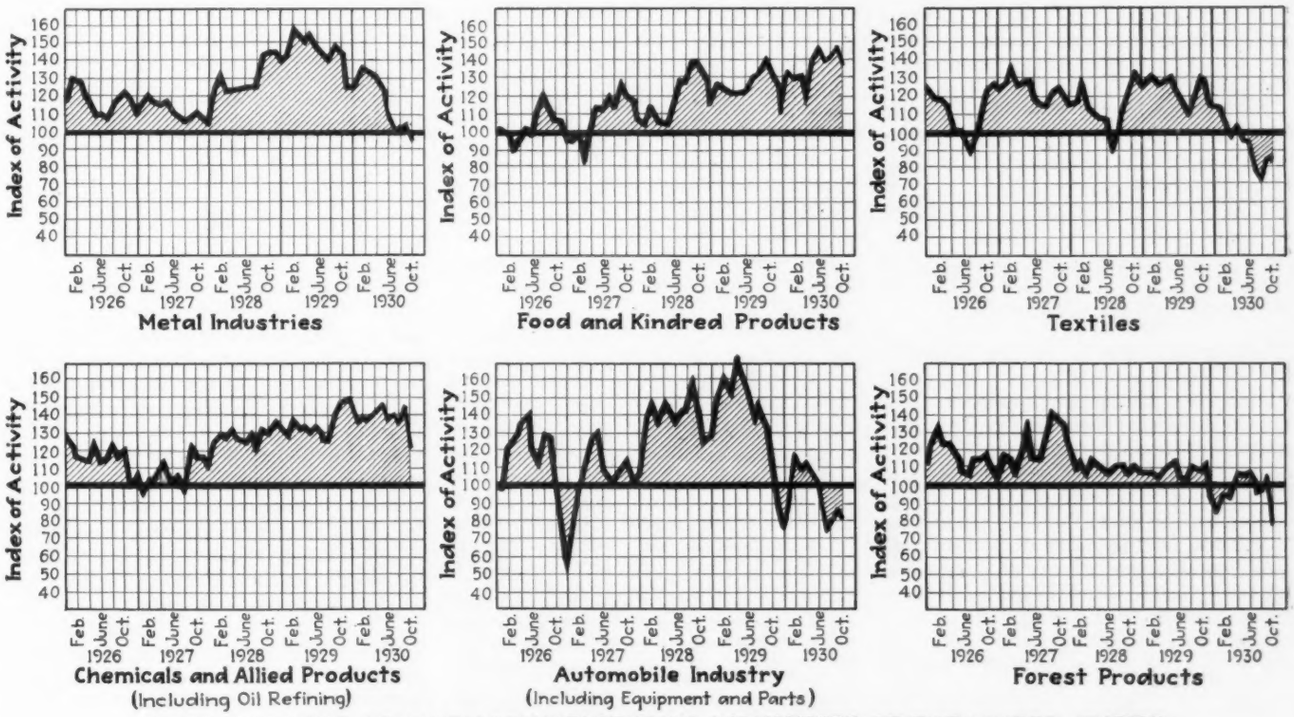
Current Manufacturing Compared with Other Periods

(Per Cent Change)

Industrial Group	Oct., 1930 and Sept., 1930	Oct., 1930 and Oct., 1929	First 10 Months of 1930 and of 1929
All industry	— 6.5	—23.4	—14.9
Chemical products (including oil refining)	—16.8	—15.5	+ 4.5
Food products	— 7.6	+ 4.1	+ 6.5
Iron and steel plants	+14.5	—12.9	—17.6
Metal working	—10.6	—40.0	—23.2
Leather products	+15.4	— 8.7	— 9.5
Forest products	—27.1	—30.8	—10.1
Paper and pulp	+ 0.6	—14.9	— 2.7
Rubber products	— 7.8	—26.8	—13.6
Shipbuilding	— 2.3	— 9.6	— 7.3
Stone, clay and glass	—11.7	—33.2	—21.0
Textiles	+ 0.4	—34.2	—24.8
Automobiles (including parts and accessories)	— 8.4	—33.8	—34.8


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
(Oct.) 101.6
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925=100
1926
1927
1928
1929
1930

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

Westinghouse Lighting Institute Starts New Course

A CORRESPONDENCE COURSE IN HOME LIGHTING, including wiring, conventional and modern lighting, lamp shade making and lighting for festive occasions, will be conducted by the Westinghouse Lighting Institute, Grand Central Palace, New York City, beginning Monday, January 5. The course is intended primarily to stimulate home lighting by providing basic information on ways and means of making homes more homelike through both decorative and improved lighting, by simple changes and additions and by personal preferences in lamps or fixtures.

This is the second correspondence course conducted by the Westinghouse Lighting Institute, the first study, completed recently, dealing with general illumination and having a record enrollment of more than six thousand.

The home-lighting course will be confined to everyday practical lighting considerations rather than to those of a highly technical character.

This is said to be the first time that information of this kind has been made available by correspondence to those engaged in the public utility field and instruction applicable to large numbers provided. Instruction will be of interest, especially to women of the electrical industry.

Registration for the course may now be made through the Westinghouse Lighting Institute, Grand Central Palace, New York.

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Trade Practice Conference Hearing on Codes

PROTESTS HAVING PROVED UNAVAILING, the standing committee of industries which have held trade practice conferences under the Federal Trade Commission's auspices has selected three attorneys to appear before the commission and specify wherein the revision made in their codes by the commission is not required to bring them into conformity with the anti-trust laws. The hearing before the commission will probably be held November 17.

The commission has extended until September 15 the time within which industries may file objections to the changes purposed in their codes. If the commission stands pat on the modifications tentatively adopted, the prospect is that several industries will abandon further attempts to do business with the commission and rely in the future upon the advice of their own attorneys on questions of policy.

Louis E. Flye, Boston, general counsel of the National Plumbing and Heating Institute, Chicago; E. Barnett Prettyman, Washington, D. C., attorney, and Sol A. Herzog, New York attorney, were selected at a meeting November 5 of the standing committee to present to the Federal Trade Commission the arguments of the Congress of Industries in opposition to the proposed revision of trade practice conference rules.

Canadian Company Boosts Appliance Sales

THE TOTAL VALUE of domestic appliance sales in September by Canadian Hydro-Electric Corporation, Ltd., a subsidiary of International Paper & Power Company, was 62 per cent over September of last year. The number of electric lamps sold in September was more than 4½ times the number sold in the corresponding month last year, and the total number of other appliances sold was more than double. Of the total value of merchandise sales in September this year, electric ranges and refrigerators constituted 35 per cent.

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Cullinan Gets Wholesalers' Medal Under James H. McGraw Award

THE wholesalers' medal and purse for 1930 given under the James H. McGraw award was presented to George E. Cullinan, vice-president of the Graybar Electric Company. The award was made at the meeting of the National Electrical Wholesalers' Association at Pittsburgh this week in recognition of Mr. Cullinan's constructive contribution to the advancement of the wholesaling branch of the electrical industry.

In 1925 this award was made to William R. Herstein and in 1927 to O. Fred Rost. No awards were made in 1926, 1928 and 1929. The committee of judges consisted of J. L. Owen, George Patterson and Walter Williamson.

The citation follows:

George E. Cullinan, vice-president of the Graybar Electric Company, as sales executive of the largest independent chain of wholesale houses exclusively distributing electrical equipment and supplies, has been a student of distribution problems and a leader in the promotion of a better economic organization. For years he has unselfishly and persistently applied himself to the education of the electrical wholesaling industry in the analysis and control of the cost of doing business and the more efficient operation of the functions of purchase, warehouse and sales. With broad knowledge and wise judgment he has counseled the reduction of expense, the improvement of efficiencies, the intensive service of smaller territories, and the maintenance of sound business policies. He has argued the underlying principles with rare frankness and common sense, opening the books of his local houses to his competitors for the comparison of operating costs and generously contributing many valuable statistics for the encouragement of better practice throughout the industry. Finally, during a long membership on the executive committee of the National Electrical Wholesalers' Association and for three years as its chairman, he has been the exponent of constructive competition based on the economic law, of fair dealing in the development of broader markets and of intelligent co-operation in the maintenance of high standards of service.

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New N. E. M. A. Officers

NEWLY ELECTED OFFICERS of the National Electrical Manufacturers' Association include: Street-lighting section—Chairman, L. A. S. Wood, Westinghouse Electric & Manufacturing Company; secretary, F. H. Winkley, Electric Railway Equipment Company. Flexible cord section—Chairman, H. N. Otis, Anaconda Wire & Cable Company; vice-chairman, C. A. Scott, General Cable Corporation; secretary, C. O. Hull, General Electric Company. W. H. Barney, Collyer Insulated Wire Company, will replace C. W. Abbott on the technical committee.

Carbon section — Chairman, E. A. Williford, National Carbon Company; secretary, H. C. Mills, Morganite Brush Company. Manufactured electrical mica section—Chairman, Thomas Allen, Macallen Company; secretary,

M. A. Chapman, Mica Insulator Company. Molded insulation section—Chairman, L. G. Sylvester, American Record Company; secretary (re-elected), B. E. Schlesinger, Northern Industrial Chemical Company.

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Copper at 10 Cents on Reduction Plans

WITH COPPER PRICES at present levels and stocks highest since 1921, an effort is being made by the industry to curtail output and to keep production at or near demand. It is thought, however, that the curtailment will not be drastic for the present. Canadian and African mines, despite the low level to which the price of the metal has declined, have steadily increased their production in the past year and a half. The output of Canada in September more than doubled, and that of Africa increased more than 50 per cent since early in 1929, when the price of the metal was

New York Metal Prices

	Nov. 5, 1930 Cents per Pound	Nov. 12, 1930 Cents per Pound
Copper, electrolytic	9½	10
Lead, Am. S. & R. price	5.10	5.10
Antimony	7⅛	7–7.10
Nickel, ingot	35	35
Zinc, spots	4.75	4.65
Tin, straits	25.60	25⅛
Aluminum, 99 per cent.	23.30	23.30

24 cents a pound, compared with 9½ cents at present. The current output of Canada is estimated at approximately 25,000,000 lb. monthly, against 10,916,000 lb. early in 1929, while Africa is producing now about 29,000,000 lb. a month, compared with 18,960,000 lb. early last year. In the meantime, the output of the copper mines in the United States has declined from 220,600,000 lb. a month to about 137,000,000 lb., a decrease of 37.9 per cent, and those of South America from about 80,000,000 lb. to 52,750,000, or about 34 per cent.

Plans for a world-wide reduction in the output of copper have virtually been completed and have aroused a scramble to buy. Consumers evidently believe that the cut in output will be sufficient to change the general situation to a sellers' market. A large tonnage of copper was sold during the week, but it was not until Tuesday that the price showed any variation. Early Tuesday numerous bids came out for copper at 10 cents, at which figure a fair tonnage was sold. On good authority it can be stated that the reduction agreed upon will approximate 23,000 tons monthly, from a monthly output of approximately 150,000 tons.

Sales during the week were very large, domestic and foreign business totaling about 75,000 tons.

Argentina Profitable Market for Our Electrical Goods

THE recent settlement of political affairs in Argentina adds to the attractiveness of an already profitable market for electrical equipment and appliances. Last year Argentina's purchases of electrical goods from this country totaled over nine million dollars. This is less than half of her total electrical imports. But America is getting a larger share of the total year by year, and there are indications that aggressive development will result in a much larger share, as well as total, for this country.

The leading items for which Argentina offers increasing opportunity include lamps, meters, wire and wiring supplies, insulating conduit and small motors. There is a growing market for virtually all classes of appliances, including refrigerators, fans, electric cookers and the other smaller domestic lines. Electric fans are used for a great part of the year and are becoming more common. Electric refrigerators are being backed by heavy advertising and careful selection of distributors, and the market is regarded as very large. American makes largely control the market. Electric ranges used are usually smaller sizes. Facilities for heating Argentine homes and offices are required for three or four months each year, and the electric radiator is finding much favor, as central heating plants are rare in private homes.

How to develop the market

There are various methods of marketing American-made electrical goods in Argentina and other South American countries. In the appliance field a substantial volume of the sales are made through the power and light companies, whose chief interest is the development of load. Appliances sold in this way are largely of American origin. Next to this method is the assembling of noncompetitive lines with similar markets under a combination export man, as in the United States, or an established importer in Buenos Aires, whose facilities are already set up. Combinations of this kind on the part of American manufacturers frequently eliminate overhead and reduce rates. This is the advisable procedure in many cases for the small exporter, rather than setting up his own facilities in a limited way. The cost of setting up machinery is frequently high, and it is not always advisable for the small man to endeavor to build up his own channels. Where he does wish to appoint an exclusive agent, however, he may secure valuable assistance through the Bureau of Foreign and Domestic Commerce in Washington or from *Electricidad en América*, the electrical merchandising magazine of the McGraw-Hill export group. Some business is always done, of course, on consignment, and some on open account.

Type of generation

There are few hydro-electric plants in Argentina. Central stations are in the larger centers principally, and those in smaller centers are frequently isolated. There are few transmission lines. Direct current is used in most interior towns, but alternating current is in use in several places and is being rapidly extended. The market for transformers is limited and buying sources are well established, leaving little open market business. As already indicated, the market for meters is fairly open. Those required most extensively handle 220-volt alternating current with capacities of 2 to 10 amp. England has stood first in the past as a supplier of switchboards, and Germany supplies a large proportion of the circuit breakers.

Wire and cable, of which Germany and England are the largest suppliers, constitute more than one-third of all electrical imports, as Argentina is a price market for these products. Light types of low-capacity wire are manufactured locally, but there seems to be a growing demand for the better grades.

Data are not available to show the types and sizes of motors imported, but the greater number are from 1 to 20 hp., constant speed, without inclosing covers. Legislation requiring safeguards for workmen is not highly advanced, hence installations with ironclad boxes are rare. Starting switches and rheostats are used generally. Motors are usually of the slip-ring type.

Who are the buyers?

The market for heavy equipment in Argentina consists of the power and light companies, the mines and some industries, and to some extent the railways. The power and light industry is almost completely on a private ownership basis. Independent utilities are the buyers. A substantial volume of American capital is invested in Argentine power and light companies. Properties are controlled by the Intercontinents Power Company of Harrisburg, Pa.; American & Foreign Power Company, etc. In such cases the purchases are made through the purchasing departments of these companies located in this country, on specifications from the field.

Market Conditions

MACHINERY orders featured Pacific Coast business this week, while line material and staple business are expanding appreciably. Substantial railway and municipal orders are reported from the Eastern district. Industrial business has dropped off. New England and the Southeast report business still marking time.

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PACIFIC COAST

—SEVERAL OUTSTANDING MACHINERY ORDERS *featured the past week. Staple business, both wiring and apparatus, is slowly improving, with line material also showing better sales.*

—AS A WHOLE, THE INDUSTRY *has weathered the past few months of depression remarkably well, largely by constructive policies and vigorous credit and collection following.*

Machinery orders include a $35,000 Westinghouse projection room pilot board for Los Angeles, $225,000 worth of 25,000-kva. Westinghouse oil-cooled transformers for southern California, and an installation of 750-kva. General Electric transformers valued at $18,000 for Soledad. The recent boom in Pacific Coast shipbuilding is reflected in orders covering $25,000 worth of commercial cooking apparatus and a $45,000 switchboard placed in San Francisco for a shipbuilding firm. The city of Vernon proposes to install a 35,000-kva. plant costing $4,000,000. Power companies have bought carloads of crossarm braces, miscellaneous bolts and guy strand. State business is small and scattered, but the city of San Francisco is in the market for 600 metal and 300 concrete street-lighting standards for boulevard lighting and fixtures for the county home. Other street-lighting business is quiet, with smaller installations proposed for Santa Barbara, Redwood City, Santa Ana, Alturas and Visalia. Government business is brisk, though not electrically. It includes 24 electric drills and ten motor-driven lathes for San Diego. Major construction projects are few, with a $1,000,000 theater each for Sacramento and Los Angeles and a $1,000,000 warehouse for Los Angeles. The $2,000,000 associated oil cracking plant at Avon provides still another new industrial for the upper San Francisco Bay area, where close to $10,000,000 of construction is under way or close to it.

Sales volumes in the Seattle and Puget Sound districts were reported light last week, with indications pointing to a continuance until well after the first of the year. Projected additions to pulp and paper mills and constructing of additional plants are postponed indefinitely, it is stated, with several plants planning on decreasing production. Sales announced include $40,000 worth of suspension type insulators to Puget Sound Power & Light Company by Graybar Electric Company, 25 motors from 30 hp. down to miscellaneous sources, 35 from 100 hp. down to mills, allied industrials and dealers and ten from 75 hp. down to a woodworking plant. Specifications are out for about $4,000 worth of transformers from 25 to 3.33 kva. and about 50 motors from 50 hp. down for a Puget Sound lumber mill. City of Seattle is taking bids until November 21 for materials and labor involved in construction of power house of Diablo unit of Skagit hydro-electric power project and preliminary specifications have been written for approximately $500,000 worth of apparatus for the spring street substation, on which bids will be invited early next year. Seattle lighting department bought 100,000 ft. of ⅝-in. galvanized guy wire for $16.92 per 1,000 feet, less 2 per cent, and the lighting department sold 303 electric ranges, the majority to residences, during October. During a like period the Puget Sound Power & Light Company, throughout the territory served in Washington, sold 370 electric ranges to residences and 130 to apartments.

CONSTRUCTION PROJECTS

Associated Oil Company, San Francisco, Calif., will build an addition to Avon refining plant, near Martinez, Calif., to cost $1,500,000. Philadelphia Quartz Company, Berkeley, Calif., has plans for a plant at South Gate, Los Angeles, Calif., to cost $300,000. Scripps Institution of Oceanography, La Jolla, Calif., will build a laboratory addition to cost $115,000. Pacific Gas & Electric Company, San Francisco, Calif., plans rebuilding of transmission line near Chico, Calif., to cost $40,000, and will build a service plant at Redwood City, Calif., to cost $50,000. Sacramento, Los Angeles and Red Bluff, Calif., plan ornamental lighting systems. Montana Power Company, Butte, Mont., plans transmission lines in Cascade, Chouteau, Teton and other counties. Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids (no closing date stated) for electric light and power systems, cranes and hoists, cableway, conveyors, etc., for naval ammunition depot at Hawthorne, Nev. (Specification 6125.)

SOUTHWEST

—CONDITIONS REMAIN AS PER PREVIOUS REPORTS, *with stock size orders no less, but perhaps just a shade better. Practically no transmission line material shipments were made and holiday sales of appliances are below normal.*

Orders were placed for a 1,500-kw. turbo-generator unit with surface condenser by a company in southeast Missouri to cost $45,000, a 1,500-kva., three-phase transformer for Arkansas hydro-electric plant to cost $10,000 and a lot of medium-sized transformers for another Southern power company costing $4,000.

CONSTRUCTION PROJECTS

Southwestern Gas & Electric Company, Texarkana, Ark., plans power substation at Mineola, Tex., to cost about $50,000. Baton Rouge Electric Company, Baton Rouge, La., has filed plans for an equipment and service building to cost over $60,000. Gulf, Mobile & Northern Railroad Company, Mobile, Ala., has plans for terminal and railroad shops at New Orleans, La., to cost about $1,000,000. Monterey Light & Power Company, Monterey, Mexico, has approved plans for a steam-operated electric power plant at Colonia Bella Vista, near Monterey, to cost $1,000,000.

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MIDDLE WEST

—BUSINESS IN THE *Middle West section appears to be marking time. A considerable number of favorable indications of the return of business is being observed, and it is generally felt that some improvement, however slight, is being made.*

—MAJOR ACTIVITIES ARE APPARENTLY *in about the same position as last week and some slight increase in employment is recorded. Retail trade has increased and sales of the large mail order houses are better.*

The railroads are coming into the market for large commitments of rails and equipment and more forward buying is being indulged in. While the plans for expansion in the utility field are somewhat smaller for 1931, a considerable amount of this construction is getting under way. Some of the interesting items placed this week include a contract for circulating water piping, valves, fittings, etc., complete with appurtenances to cost $110,000, 50 75-kva., single-phase, pole type distribution transformers, 30 current transformers, 600 to 5 ratio, and several underground conduit jobs to cost $65,000.

CONSTRUCTION PROJECTS

Wisconsin Power & Light Company, Madison, plans transmission line from Birnamwood to Wittenberg, Wis., reported

to cost over $50,000. Board of Water Commissioners, Detroit, Mich., will receive bids until November 25 for three electric traveling cranes. Grigsby-Grunow Company, Chicago, Ill., will build an addition to power house at radio equipment plant to cost $125,000. Chicago & North Western Railroad Company, Chicago, Ill., plans extensions in warehouse terminal to cost over $1,000,000. Pullman Company, Chicago, Ill., plans laundry for railroad linen to cost $500,000. Board of Education, Chicago, Ill., plans vocational training department in proposed Steinmetz High School, to cost $2,000,000. Indiana State Sanitarium, Rockville, Ind., plans power plant, shops and institutional buildings to cost $1,500,000. State School for Feeble-Minded, Fort Wayne, Ind., contemplates power plant to cost over $100,000. North Dakota Power & Light Company, Bismarck, N. D., plans addition to power plant at Mott, N. D. Minneapolis and Deer River, Minn., plan ornamental lighting systems. Interstate Power Company, Dubuque, Iowa, plans extensions and improvements in power plant at Coleridge, Neb. Central States Electric Company, Cedar Rapids, Iowa, plans power substation at Independence, Iowa.

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SOUTHEAST

—THE PAST WEEK *was a quiet one in the electrical field of the Southeast, manufacturers reporting a fairly well-sustained volume of orders from central stations for repair parts and replacements, but no large individual orders. A quickened life is noticeable among the industrials and the spring should see some interesting developments.*

The city of Nashville, Tenn., ordered last week one car of weatherproof wire for use in connection with changes in the street-lighting system. Some central station orders reported were for $4,110 of insulators, $3,910 of distribution transformers, $3,855 of meters and guy wire amounting to $2,584. A Florida west coast company has inquiries out on 150,000 lb. of bare and weatherproof copper wire and a Tennessee company has asked for bids on 25,000 lb. of weatherproof cable. A steel mill in Alabama ordered renewal parts amounting to $8,000 and a coal mine in Tennessee purchased motor and control equipment totaling $5,000.

CONSTRUCTION PROJECTS

Ohio River Motor Boat Company, Newport, Ky., plans boat-building and repair plant to cost $100,000. American Tobacco Company, Durham, N. C., contemplates storage and distributing plant to cost $150,000. Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids (no closing date stated) for 10-kw. exciter, switchboard, cables, etc., for marine barracks at Parris Island, S. C. (Specification 6284). Water Valley, Miss., plans ornamental lighting system. Tampa Shipbuilding & Engineering Company, Tampa, Fla., contemplates expansion program at shipyard to cost over $1,000,000.

EASTERN

—RESTRICTED SALES CONTINUE TO DOMINATE *the electrical equipment market in the Eastern district. Railway and municipal accounts are the outstanding features of current demand and the transactions in these lines are assisting the situation materially. Prospects for a revival of central station call are rather encouraging, as indicated by the present rate of inquiries, and several important contracts are pending for heavy equipment.*

—INDUSTRIALS ARE LIMITING THEIR PURCHASES *to immediate requirements in the line of motors, controls and similar apparatus, and the outlook shows no change for several weeks to come.*

The municipal railway system at New York has placed an important order with a state manufacturer for a considerable amount of equipment, totaling $2,158,000, and easily one of the largest commitments on any account for some months past; the contract calls for transportation apparatus, transformers, switchgear, mercury-arc rectifiers, wire and cable, and other substation and line equipment. The Delaware, Lackawanna & Western Railroad has given an award to the same manufacturer for shift-gear transformers and accessory apparatus to an amount of $40,000. A Western Pennsylvania maker will furnish a steam turbo-generator unit for a municipal installation in North Carolina, the contract for boilers going to a New York company and for superheaters to a Philadelphia producer. A New York manufacturer has taken an order for voltage regulators, control switchboard panels and equipment and other miscellaneous apparatus for a hydro-electric power project now under way in Missouri.

Industrial business is scattered, and while the metal-working interests, including iron and steel mills, have been fairly well in the market for motors and affiliated equipment, this account gives indications of lagging. Chemical plants as well as textile mills have been making some limited purchases. Inquiries have declined in this line and not much activity is anticipated until the turn of the New Year. Holiday demand in the appliance field has fallen short of that of a year ago up to this time. Jobbers are hesitant and retailers are restricting their stocks. Electric refrigerators and vacuum cleaners continue to have a good following, and three leading manufacturers are running on a capacity basis.

CONSTRUCTION PROJECTS

Electro Metallurgical Company, New York, has approved plans for additions to plant at Boncar, W. Va., to cost over $1,000,000. General Bronze Corporation, Pittsburgh, Pa., plans plant at Long Island City, N. Y., to cost over $100,000. Prest-O-Lite Company, Inc., New York, contemplates plant at Chicago, Ill., to cost over $100,000. Pennsylvania Railroad Company, Philadelphia, Pa., plans produce terminal at Baltimore, Md., to cost $600,000. Emlenton Refining Company, Emlenton, Pa., will build addition to gasoline refining plant to cost $200,000. Baltimore & Ohio Railroad, Baltimore, Md., contemplates passenger and freight terminal at Johnstown, Pa., to cost over $300,000. Pennsylvania Power & Light Company, Allentown, Pa., contemplates transmission line construction in connection with acquisition and consolidation of 28 utilities operating in eastern Pennsylvania. Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids (no closing date stated) for transformers, switchboard panels, wire and cable, and accessory equipment for the naval air station at Anacostia, D. C. (Specification 6244.)

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NEW ENGLAND

—ORDERS FOR ELECTRICAL EQUIPMENT *for the past week in this district show little change over the previous week. Small motors are moving fairly steadily.*

—GENERAL SCHEDULED MATERIALS, *according to one manufacturer, are in greater demand than last month at this time; central station supplies are receiving little attention. Interior illumination in connection with new construction projects is being considered on an encouraging scale.*

Recently contracts let for intercommunication equipment, interior lighting and sound signals for institutional buildings amounted to over $75,000. Announcement of a number of new theaters in this district presages a large volume of special lighting effects for the near future. Among other specialties receiving study are additional street lights for a number of localities, new traffic signals and major domestic appliances. The latter include steadiness in radio, and washer orders.

CONSTRUCTION PROJECTS

Public Service Company of New Hampshire, Manchester, plans extensions and improvements in hydro-electric power plant at Franklin, N. H., to double capacity. Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids (no closing date stated) for air compressors for the Boston navy yard (Specification 6280). Holyoke Light & Power Company, Holyoke, Mass., plans addition to power plant, including installation of generating unit.

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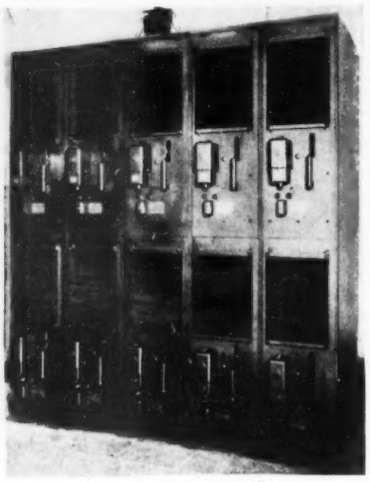
In the November 1 issue, Middle West section, page 845, the name "Eastern Minnesota Power Company," Pine City, Minn., should have read "General Minnesota Utilities Company."

New Equipment Available

Metal-Inclosed Switches for 600-Volt Operation

METAL-INCLOSED SWITCHGEAR of the draw-out type designed for 600-volt operation has recently been placed on the market by the General Electric Company, Schenectady, N. Y. Each



unit of this switch includes a double tier stationary element and two removable circuit breaker elements. Electrically or manually operated trip-free air circuit breakers, or oil circuit breakers, up to 7,500 volts, 600 amp. or 600 volts, 800 amp. can be used. This type of gear can be adapted to a single- or double-bus, double-breaker arrangement.

The stretcher-leveled steel panels of the switch are mounted on removable elements and are provided with insulating levers. Interlocks securely hold the removable element in operating position and automatically trip the circuit breaker when the removable element is withdrawn or inserted.

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Herringbone Rotors Improve Motor Operation

ELECTRIC MOTORS, USING HERRINGBONE ROTORS which are said to effect noiseless operation, to eliminate end thrust and the resulting wear on bearings, to eliminate noise of bearings, friction losses, back and forth lateral pounding, and circulating currents, to improve pull-out efficiency and power factor, and to reduce exciting current, heating, eddy currents and iron losses are announced by the Sterling Electric Motors, Inc., Los Angeles, Cal. These rotors are claimed to be indestructible since they are made by a special die-cast process which consists of casting the electrical element of pure aluminum directly upon the magnetic core.

The life of the windings in Sterling motors is increased by the use of built-in mica and abestos, according to the manufacturer. The windings are also heat impregnated with heat-resisting and moisture-proof compound.

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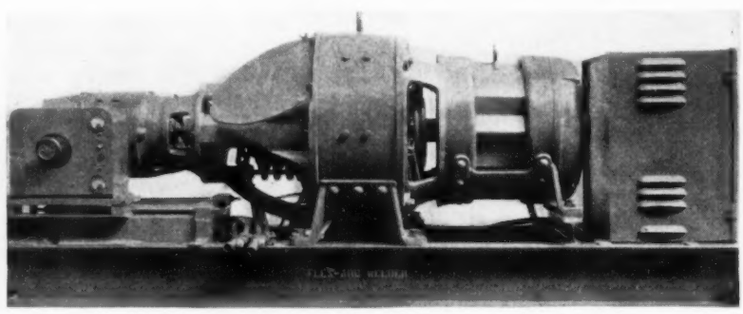
Motor-Driven Welder Delivers 600 Amp.

MOTOR-DRIVEN, SINGLE-OPERATOR, 600-amp. welders have recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These welders are designed to handle various sizes of electrodes, including those requiring current values up to 750 amp.

The motor is connected to the generator by a common shaft with two bracket type bearings and a two-bearing exciter overhung from the commutator end of the main generator. The new Westinghouse "Flexactor," which is said to provide a non-surge welding circuit and extraordinary arc stabilization, is mounted on a welded channel base under the exciter. The control, which includes a single-dial field rheostat for adjusting the welding current, an ammeter, voltmeter and a starter push button, is inclosed in a sheet-metal cabinet mounted beside the welding outlet leads. The driving motor is provided with a push-button-operated magnetic type starter.

The main generator operates on the variable-voltage, constant-current prin-



ciple with a separately excited shunt field and a bucking series field. The over-all dimensions of the stationary motor-driven unit shown in the illustration are 96x29x40 in. Its weight is approximately 4,500 lb.

Small Rotary Converters for 110-V., 60-Cycle Service

ROTARY CONVERTERS EXPRESSLY DESIGNED to make possible the use of neon signs, radio receiving sets, X-ray apparatus and similar appliances built to operate on 110-volt, 60-cycle alternating current in localities where only direct current is available are announced by Robbins & Myers Sales, Inc., Springfield, Ohio. Simplicity of construction, silent, trouble-free performance, unusual durability and absolute freedom from radio interference are the outstanding characteristics claimed for these converters.

Precision bearing design employing the latest wool-yarn type lubrication system is said to insure smooth operation. Binding posts are conveniently located for easy installation.

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High-Torque Starting Permitted by Clutches

CLUTCH PULLEYS AND CLUTCH COUPLINGS which are entirely automatic both in pick-up and release on overload and which keep the load on the motor within adjustable predetermined limits are announced by the Hill-Clutch Machine & Foundry Company, Cleveland, Ohio. These clutches are particularly adapted to direct-connected or belt drives operated by electric motors.

The operating principle of the clutch is simple. There are two main parts, an inner rotor, carrying impeller blades having orifices at the points where they are attached to the shaft, and an outer shell with serrations set lengthwise all around its inner face. The impeller portion is connected to the drive side of the clutch and the outer shell to the machine to be driven. Chilled shot are contained in the shell.

On starting the motor, the impeller blades revolve, driving the shot before them over the serrated surface. Part of the shot escapes through the impeller orifices and part is thrown outward against the serrations. As the motor speed increases, more shot are forced outward to transmit more power